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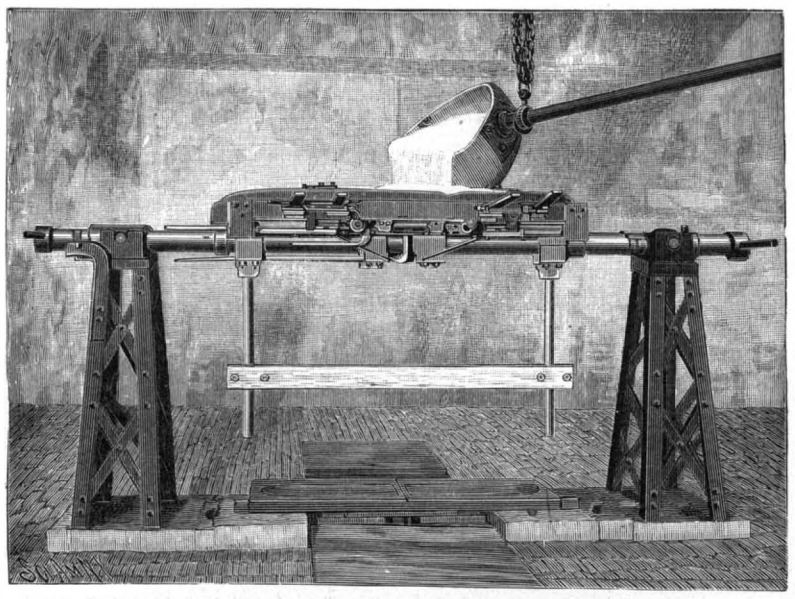


Fig. 1.—Pouring the Molten Glass on the Plate.

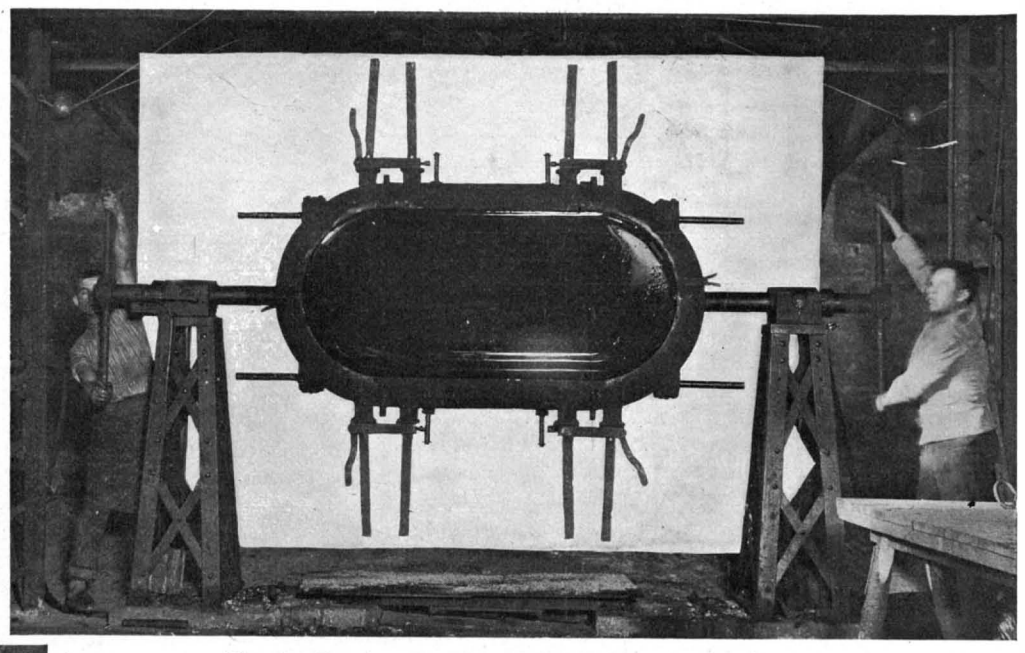


Fig. 2.—Turning the Plate of Plastic Glass.

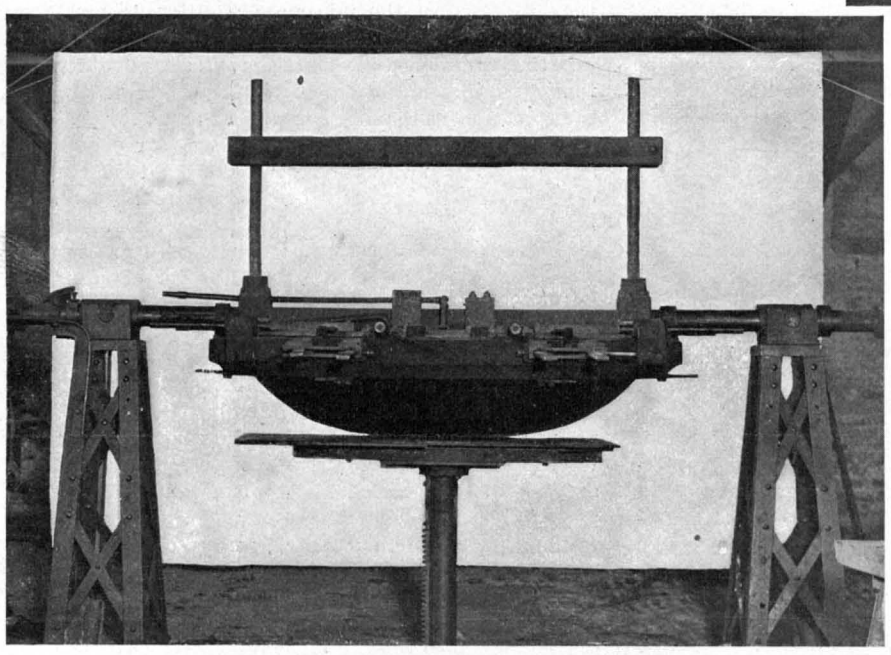


Fig. 3.—Forming the Bottom of the Bathtub.

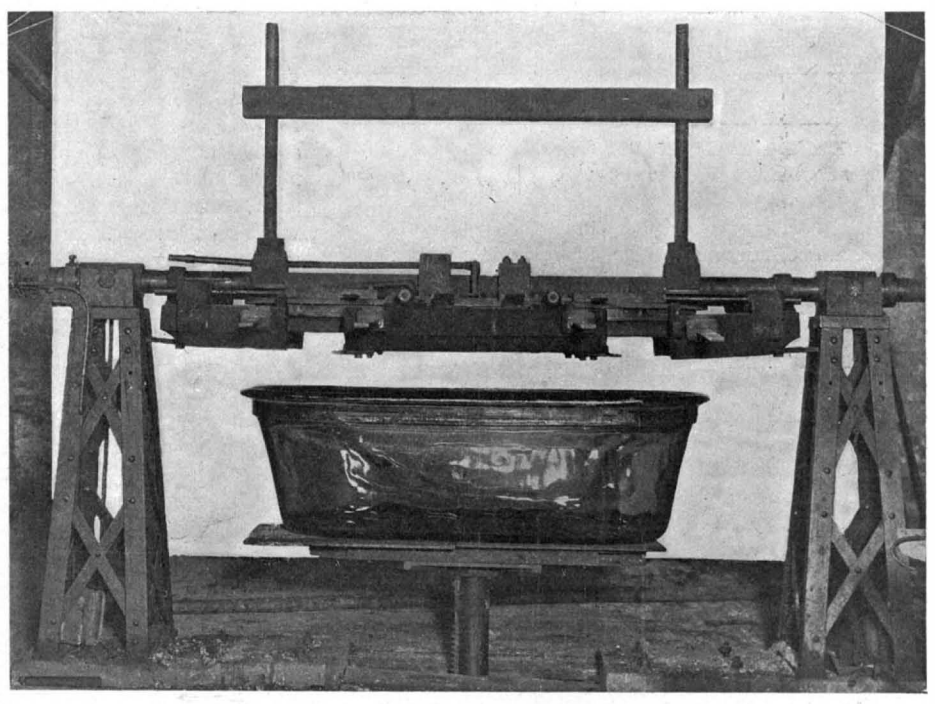


Fig. 4.—The Finished Bathtub of Glass.

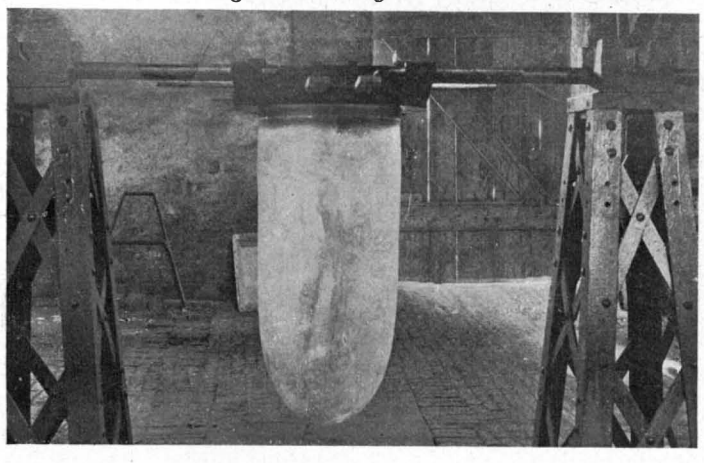


Fig. 5.—Blowing a Cylinder for Window-Glass.

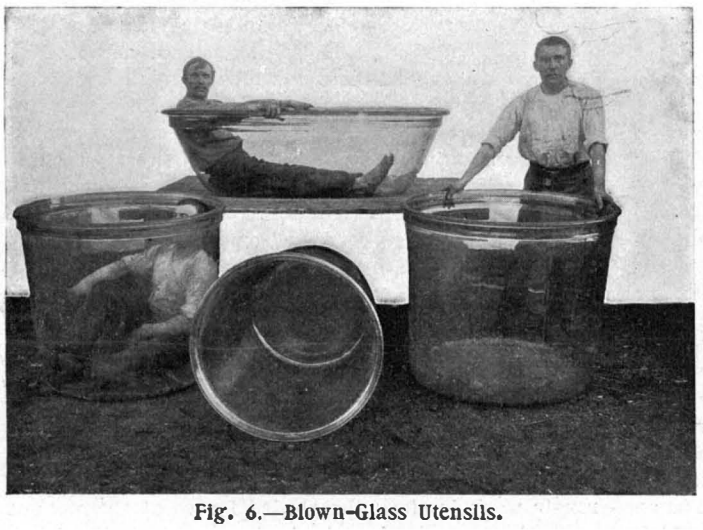


Fig. 6.—Blown-Glass Utensils.

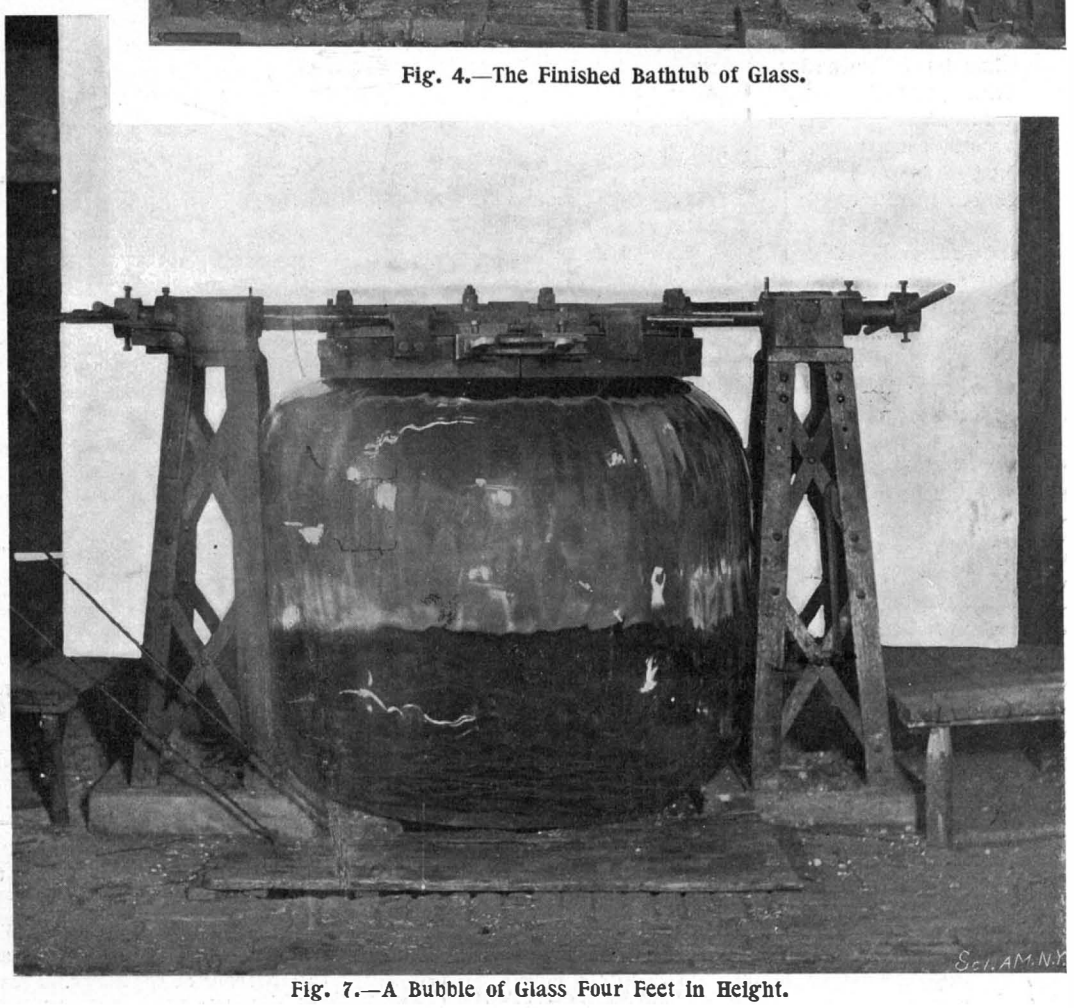
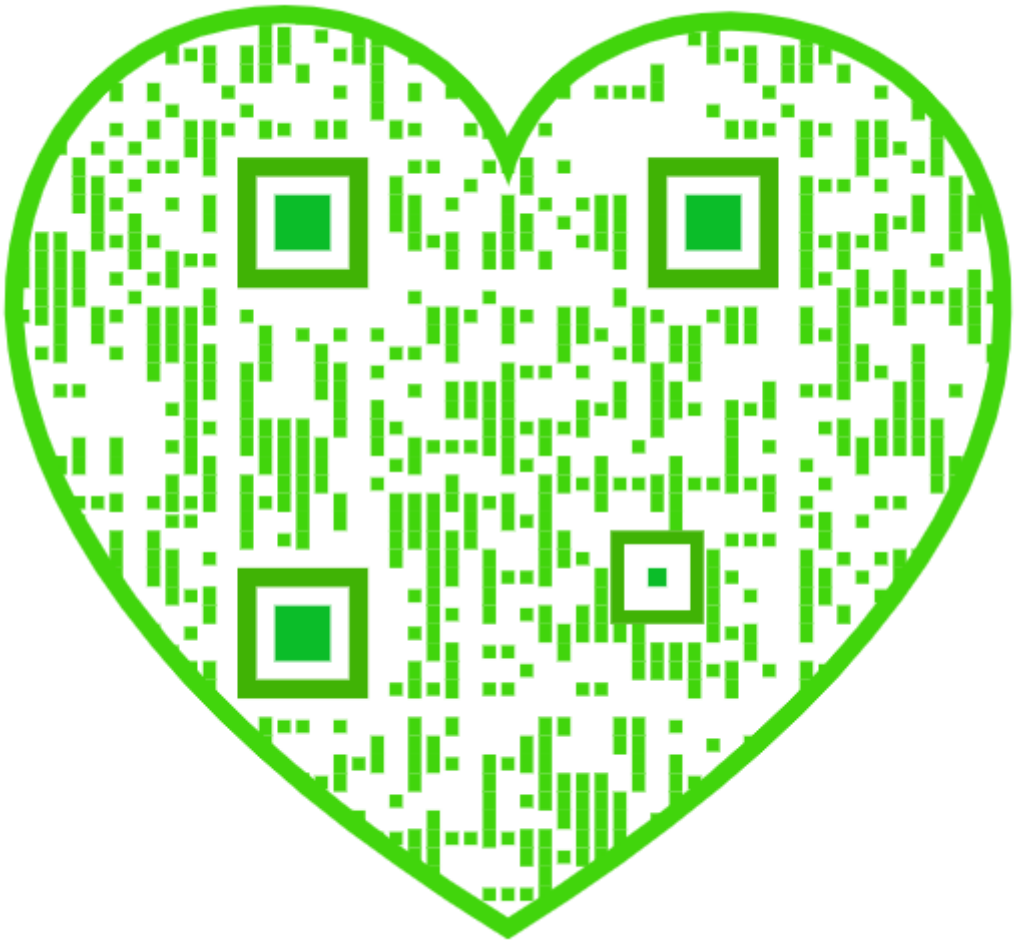


Fig. 7.—A Bubble of Glass Four Feet in Height.

A NEW MEANS OF USING COMPRESSED AIR IN THE MANUFACTURE OF GLASSWARE.—[See page 329.]



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NEW YORK, SATURDAY, MAY 10, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

FASTEST AUTHENTIC RAILROAD RUN ON RECORD.

The fastest run ever made by a railroad train for the distance was that accomplished last month on the Burlington and Missouri River Railroad, between the two stations of Eckley and Wray, Colo. The two towns are 14.8 miles apart, and the run was made in an even nine minutes, which works out at a rate of 98.66 miles per hour. The train was made up of a mail car, baggage car, two chair cars, three sleeping cars, a dining car, and a private car, or nine cars in all. It was drawn by a ten-wheel engine with 19-inch by 26-inch cylinders, and 72-inch drivers; the line is on a downgrade with a maximum of 32 feet to the mile. The timing of the train was done in the observation car by five watches, one of which was held by the conductor, and the record is considered to be so accurate and well authenticated that it has received the official confirmation of the Chicago, Burlington and Quincy Railroad.

PERILS OF SUBMARINE NAVIGATION.

The submarine torpedo boat "Fulton," during the course of her coastwise trip to the South from New York Harbor, made a successful run to the mouth of the Delaware, but, unfortunately, as she was rounding the Breakwater, there was an explosion of gas within the boat, which more or less seriously injured five of the crew. The run seems to have been fairly successful, the "Fulton" having made several dives during the night as she was passing down the Jersey coast, on one occasion remaining submerged for a distance of two miles. Probably it would be unjust to ascribe the accident to any special features of the submarine as such, since explosions due to the same cause occur in gasoline launches. At the same time it cannot be denied that the use of gasoline as a fuel becomes particularly perilous in this type of torpedo boat, where the chances of escape in the case of accident are very remote.

THE GATHMANN GUN AGAIN.

According to reports from Washington, Lieut.-Gen. Miles has issued an order reconvening the Board of Army and Navy officers which conducted the test made last fall at Sandy Hook of the Gathmann gun, for the purpose of "considering the statements made by the president of the Gathmann Torpedo Gun Company, regarding the results of the tests of their 18-inch gun, as reported to the Board, and to make replies thereto." It will be remembered that the Gathmann gun was designed upon the theory that if you can deliver a shell charged with a large amount of guncotton against the hull of a battleship and detonate it there, the sides of the vessel will be blown bodily inward and the ship, of course, sent to the bottom. The test referred to was made at the request of the Gathmann Company in competition with a service 12-inch army rifle, firing ordinary shells. Each gun delivered its attack against an 11½-inch Krupp plate, backed up by a structure representing a section of a modern battleship's side. After three rounds, the Gathmann gun broke the plate in two without penetration, while the army gun penetrated its plate and completely tore to pieces both the plate and backing. The Board reported that while the army gun, firing maximite and explosive "D," was successful beyond expectation, the Gathmann gun failed to do any injury to the target commensurate with the size of the gun and the enormous charges of high explosive employed. It seems to us that the question is one of relative efficiency. The Army naturally desires to secure the most serviceable gun, shell and detonating fuse; and while the Gathmann gun did considerable execution, in our opinion it was not at all comparable with that done by the service gun; indeed, we cannot see how the Board could have arrived at any other conclusion as to the relative merits of the two types, than that which they gave in their report. For a lengthy description of these famous trials and photographs showing the condition of the two armor plates after trial, reference is made to the SCIENTIFIC AMERICAN of November 30, 1901.

FESSENDEN'S ELECTRIC WAVE-DETECTOR.

Widespread interest has been aroused by the experiments which have been carried on by Prof. Fessenden with a new form of aerial telegraphic receiver, which is claimed to give promise of considerably greater rapidity than the coherer with which the public is generally familiar. The experiments have been carried out under the auspices of the Weather Bureau, and have extended over a period of about two years. Some of the results achieved have been made public by the Bureau, and they are considered to foreshadow a great improvement in the speed of aerial telegraphy. The work has been carried on between Hatteras Inlet and Roanoke Island, over a distance of fifty miles, and messages have been sent and received without the use of the coherer, the place of which is taken by the new receiver, which Prof. Fessenden calls a wave-detector. He claims that he has worked it experimentally at speeds which would be equal to over five hundred words a minute, and this with only about twenty-five per cent increase of energy per signal over that which is used with the ordinary apparatus. We understand that the wave-detector consists of a wire whose conductivity is automatically increased and diminished through a range which can be determined by the adjustment of the apparatus, and that the making and breaking of the circuit is so delicately adjusted that the higher speeds are easily realized.

ATTUNED WIRELESS TELEGRAPHY.

After eight years of litigation Prof. M. I. Pupin, of Columbia University, whose brilliant inventions in long-distance telephony are fresh in the public mind, has been granted his application, made in 1894, for a system of selective resonance, or "tuning" as it is popularly called, of electrical circuits. As far back as May 17, 1893, Pupin delivered a lecture at the general meeting of the American Institute of Electrical Engineers, in this city, on "The Practical Aspects of Low-Frequency Electrical Resonance;" and on applying for his patent he was surprised to discover that similar applications had been made by a member of the French firm of Hutin & Le Blanc, and by Mr. Stone for the Bell Telephone Company. The decision in Pupin's favor was made known to him a few weeks ago, and the result naturally takes on special significance when it is learned that up to date something like two hundred applications for patents on systems of tuning electrical circuits have been filed at Washington.

At the time that his investigations were started, Pupin had in mind the application of tuning to ordinary telegraphic circuits; for wireless telegraphy could scarcely be said to be in the air at that time. Immediately upon the successful development of Marconi's investigations in aerial telegraphy, the question of tuning naturally took on a new significance. Briefly stated, Pupin's system provides for the construction, in connection with a given line, of a number of branch electrical circuits, so arranged that each corresponds to a certain pitch of frequency, with the result that by impressing an alternating electro-motive force of a certain frequency on the line (or, in the case of wireless telegraphy, on the ether) the corresponding receiver will respond strongly. The value of this principle as applied to wireless telegraphy for the purpose of preserving secrecy, or of directing, or more properly speaking confining, the Hertzian waves to the desired receiver, is obvious. Thus, at each of six separate stations, the receiving apparatus might be arranged for a certain frequency, say 200, 400, 600, as the case might be. To make sure of the desired station, and that one alone, receiving the message, it would simply be necessary to utilize in the sending station a current of corresponding frequency.

Prof. Pupin has recently concluded an arrangement with the Marconi Company by which they are granted the exclusive license to use his system of tuning; and as these patents cover not only the United States, but every country in the world except Germany, where the obstructions placed in the way of his securing his patents were such as to lead Prof. Pupin to give up any attempt to prosecute his claims in that country, it will be seen that the position of the Marconi Company is enormously strengthened by the right to operate under this system. The method of tuning to which Marconi has so often referred as having satisfactorily solved the problem of secrecy and control, is the one originated by Pupin; and the arrangement recently announced only awaited the granting of the patents, for its final ratification.

THE NAVAL APPROPRIATION BILL.

The bill reported by the Chairman of the Naval Affairs Committee of the House asks for the generous appropriation of $77,659,386. Naturally, the section of the bill which will excite the most interest is that relating to the increase of the Navy. Provision is made for two first-class battleships of the highest type, which are to cost not over $4,212,000 each and are to have a displacement of 16,000 tons; two first-class armored cruisers to cost not over $4,659,000 and to be of 14,500 tons displacement; and two 1,000-ton gunboats, whose combined cost is to be $3,802,000. The total cost of the six ships thus provided for will be $29,500,000, of which $9,000,000 is for armor and armament.

The Report states that on January 1, 1902, there were in process of construction eight battleships, six armored cruisers, nine protected cruisers, four monitors, fifteen torpedo-boat destroyers, nine torpedo boats and seven submarine boats. Although this total of fifty-eight ships under construction would seem to indicate the activity with which the construction of our Navy is being carried forward, we regret to say that the figures are misleading, for the reason that the private firms which have undertaken the contracts for these ships are wofully behind their contracts. Out of the whole fifty-eight, no less than thirty-five are behind from nine months to over three years. Thus the battleships "Maine," "Missouri," and "Ohio" should have been completed last summer; the four monitors in March, 1901; the fifteen torpedo-boat destroyers were contracted to be completed in April and May, 1900; the torpedo boats should have been completed between January and November, 1899, and the submarine torpedo boats between April and October, 1901.

This shameful state of things, for it is nothing less, proves that so far from the work of upbuilding our new Navy and properly safeguarding the naval interests of the country being in a satisfactory condition, it is in an extremely backward and, if we bear in mind the enormous activity of other nations, positively neglected condition. That this is not an exaggerated statement is evident when we consider that when these ships, which are all the way from one to three years behind time, were authorized, it was considered that they represented the minimum addition to our Navy that could be made consistently with the interests of the country, and that naval programmes which are three years behind mean a relative gain in strength by the navies of competing countries. Take, for instance, the case of Germany with its sixteen-year programme and its original intention of spreading that vast addition to its fleet evenly over the sixteen years. So far from doing as we are doing, letting the whole programme run behind to the extent of two or three years, the Germans have gone to the very opposite extreme, and have reduced the term of completion by six or seven years; not only that, but they have launched other and more ambitious programmes, and are building ships, not as we are doing, more slowly, but considerably faster than was originally proposed. We do not wish to be alarmists, nor are we when we state that whereas three or four years ago we stood slightly in advance of the German Navy, to-day, owing to the apparent indifference of the private shipbuilding firms to the interests of the country, we are considerably behind Germany and we are dropping behind at an accelerated pace. We say this with a full knowledge that a few months ago we made a comparison of the United States Navy with that of Germany on the basis of ships authorized and actually commenced, which showed us to have a lead over that country; but that comparison did not take account of the relative energy with which the two countries were living up to their naval programmes. We neither knew that Germany was pushing hers through with such haste, nor that this country was falling behind her own to such an alarming degree.

It is in view of the above considerations that we feel called upon to express the most profound satisfaction at the consent of the Naval Affairs Committee to recommend the building of some warships in government yards. The Report says: "In view of the fact that there is some public sentiment favorable to building ships in our government navy yards, it has been deemed advisable for the Committee to insert a provision in the appropriation bill of this year, leaving it in the discretion of the Secretary of the Navy to build any or all of the ships in government yards, but making it mandatory on him to construct at least one battleship or one armored cruiser in such navy yards as he may designate, as an experiment; and it is further provided that he shall keep an accurate account of all expenditures for labor and material and the inspection and construction of such ships, and report to Congress at each session; and upon the completion of said ship, he shall make a detailed report, showing the relative cost of one built by the government and one by contract." The report puts it altogether too lightly when it says there is "some" sentiment; for we are satisfied that outside of the shipbuilding companies themselves, who naturally are not favorable to government-constructed vessels, there is an almost universal demand that the costly plant of our navy yards, instead of lying idle when there are no ships under repairs, shall be properly employed in the construction of new vessels. The naval constructors to a man are most enthusiastically in favor of this measure. They point out that as matters stand at present, when repair work is slack the skilled forces at the various yards have to be largely broken up and dismissed,

and that consequently there is a great loss of time and a scattering of disciplined forces which it is difficult and generally impossible to gather together again when repair work is plentiful. With a battleship and cruiser on hand at our three leading navy yards, New York, Norfolk and Boston, it will be possible to keep a force of first-class mechanics continuously employed, transferring them from repair work to new construction when it became necessary. Under the very able administration of our naval constructors, our navy yards have been brought up to such a pitch of excellence both in men and material, that they can turn out as good, and generally much better work than is produced by the private shipbuilding firms. The earlier ships built at navy yards were costly, simply because the yards of that time were saturated with the most corrupt political influences and were loaded down with political incompetents. Now the yards are absolutely freed from such control, and the work that is done is of the most thorough and up-to-date character. We most sincerely hope that Congress will see the wisdom of supporting this suggestion of the Committee. In no other way could it bring such a powerful leverage to bear in urging the private shipbuilding firms to consult the interests of the country by giving naval construction their first and not, as is now the case, their last consideration. That twenty-five of the new ships for the Navy should be from two to three years behind their contract date of completion is nothing less than a national scandal, for which the proposed construction of ships in government yards will prove to be a most efficient corrective.

AMERICAN AND BRITISH LOCOMOTIVES IN EGYPT.

Acting under instructions from the British Foreign Office, Lord Cromer has sent in a report on the comparative merits of British, Belgian and American locomotives in Egypt, which is accompanied by technical observations by Major Johnston, President of the Railway Board, and T. H. Trevithick, Chief Engineer. That the report is an impartial one must be taken for granted, as the tests upon which it is based are signed by a representative of the Egyptian railroads, and also by a representative of the Baldwin Locomotive Works, the makers of the American engines. Between 1895 and 1897, the great increase in the length and traffic of the Egyptian railways made it urgently necessary to order some seventy new engines. Among the tenders presented was that of the Baldwin Works, who offered twenty engines in twelve weeks. This was accepted, as were also tenders for fifty engines by one British and four Belgian firms.

The report is of the greatest interest, first, because of the evident fairness as stated above, of the tests and the impartiality of the report; and secondly, because it brings out very clearly both the advantages and disadvantages under which the locomotive industry of this country labors in its competition for foreign orders. The report is both favorable and unfavorable to the American locomotive. On the score of cheap first cost and speed of delivery we are easily ahead of British builders, while on the score of economy of operation, the consumption of fuel, etc., the American locomotive design seems to be unable to compete with the English engines. On the question of price, where the tenders were based upon Egyptian standard designs and specifications, the figures stood thus: In one tender the British figure was $11,200 and the Baldwin $13,500; and on another tender the British price was $16,250, as against a tender of $17,875 from Baldwin. "On the other hand," Lord Cromer adds, "the Americans offered to supply engines differing in certain particulars from the Egyptian designs and specifications, but which they held to be of equal power and equally suitable to the work which had to be performed. Under these conditions the American prices fall respectively to $9,275 and $12,375. That is to say, 19 per cent below British figures. The reason for this great fall in price is sufficiently obvious; they were able to introduce their stock standards and to advance work continuously without being hampered by, to them, unknown and unnecessary conditions. It appears, however, that it is not so much in the matter of price as in respect to the period required for the construction that the American manufacturers have had the greatest advantage. When British and American firms entered into competition, the former offered to complete the orders in forty-eight and ninety weeks, respectively. While the American offers, on the other hand, were for delivery in eighteen and thirty-five weeks if the Egyptian designs were followed, or in twelve to thirty weeks if certain changes in the designs were allowed."

In the competitive tests, however, the advantages lay decidedly with the British engine. In the freight trials, three British and two Baldwin engines competed, and each group made eight runs of 1,034 miles. The American engine hauled an average of fifty-four cars, weighing 760 tons, and the British engines an average of fifty-seven cars, weighing 868 tons. Doing this work the American engines consumed 62 pounds of coal per mile, the British engines 49.4 pounds of coal per mile, while the American engines evaporated 7.78 pounds of water per pound of coal, and the British 9.1 pounds. Mr. Machesney, the Baldwin's representative, and Mr. Higginson, the English representative, both signed the log at the end of each run. The coal was weighed and put on the tender in the presence of the two representatives, and what was left after the runs were completed, was also weighed in their presence. In the trials of the passenger engines nine runs were made by six American and two British engines, in which the average number of cars per train was thirteen and 1,345 miles was the distance run. In doing this work the American engines burned 46.3 pounds of coal per mile and evaporated 6.36 pounds of water per pound of coal, while the British engines burned 30.7 pounds of coal per mile and evaporated 8.2 pounds of water per pound of coal. The inferior efficiency shown by the American engines in these most interesting tests was certainly remarkable. Major Johnston attributes it to the following causes: Greater cylinder condensation, because of the greater exposure of the outside cylinders; increased twisting strains due to the outside cylinders; transverse strains on the coupling and connecting rods causing increased friction, due to the flexibility of the engine frame; increased friction due to the comparatively short eccentric rods and the use of intermediate rocking levers; whereas in the British type, the valve rod is directly attached to the expansion link. On the other hand, he points out the following advantages possessed by the American over the English type, and expresses surprise that they do not counterbalance more fully the disadvantages named: First, the balanced slide valves, which greatly reduce valve friction; and secondly, the more perfect regulation of the steam, owing to the elaborate rack sectors provided.

We think it is probable that the high efficiency of the English locomotive is to be found in this case rather in the boiler than in the engine; although no doubt the points in construction mentioned above have an appreciable effect. The plate frame permits the use of a firebox five inches wider than can be built within the bar frame; while the copper firebox and brass tubes of the English engines undoubtedly serve as better conductors of the heat than the ordinary steel type.

These results coming so soon after the report given by the Midland Railway, in which a similar economy was shown by English over American engines doing the same work, will attract considerable attention from locomotive builders in this country, and we would like to hear them give their own version of the great difference between the two types.

THE RECENT AUTOMOBILE ENDURANCE TEST.

Under weather conditions that were far from promising, but with bodies and machines equipped for anything the elements might have in store, eighty-two enthusiastic automobilists started on the one hundred-mile endurance test of the Long Island Automobile Club on the morning of April 26. The maximum speed of 15 miles an hour, which is the legal limit, allowed the contestants 6 hours and 40 minutes as the shortest running time they could cover the course in without being disqualified. Notwithstanding this, a dozen or more of the prominent French and American machines made the run as quickly as possible, with the result that they were disqualified. It is gratifying to note, however, that among the machines that finished early were about as many American automobiles as those of French manufacture. M. Emile Voight in a Panhard made the record time of 2 hours and 52 minutes, while the time of several other French machines was from 4 to 5 hours. Two Fournier-Searchmouts, a Knox and Oldsmobile, several Long Distance machines, and Toledo and Locomobile steam carriages arrived from half an hour to an hour later. Under the weather conditions they were obliged to finish in, which consisted chiefly of a sixty-mile an hour gale direct from the ocean, these light American machines compared very favorably with the more heavily built, powerful French racers.

A number of the gasoline and steam carriages, in order not to exceed the time limit, were obliged to go very slowly on the last part of the course. A Ward Leonard 5-horse power 1,010-pound machine arrived precisely on time, just 6 hours and 40 minutes after starting, and was followed by over thirty others at intervals of two or three minutes. The chauffeurs and their machines were covered with dust, stirred up by the gale that was blowing, and were rather grotesque objects to look upon as they arrived at the finish in Jamaica.

The decision of the judges has awarded a blue ribbon, which stands for a perfect run without a stop, to six of the competing steam carriages and fourteen of the gasoline type. This constitutes about twenty-five per cent of the contestants in each class. Three White steam carriages were entered under the same non-stop conditions as applied to the gasoline machines, being fitted with condensers for this purpose. Two of these machines won blue ribbons, and all three arrived at the finish within a few seconds of each other. All the other steam carriages were allowed stops to take on water and fuel. The test was a most severe one for this type of machine because of the strong wind blowing. This put out the fire in a good many instances, and made a stop necessary to relight it.

The hill-climbing contest at Roslyn was encountered successfully by all the machines. The roadbed was good and the ascent gradual, there being no sharp pitches. The hill is about half a mile long and the grade is not greater than 15 or 20 per cent. The steam carriages made the best showing when it came to climbing this hill, the gasoline machines equipped with three speeds taking it next best, and the two-speed gasoline rigs climbing it for the most part on the low gear, at a rate of five or six miles an hour. The best time on the hill was made by a Rochet-Schneider gasoline machine, which made the ascent in 1 minute 19 seconds, and was awarded two cups therefor. A locomobile was first in the steam carriage class, its time being 1 minute 42 seconds; an autocar and a Winton were the winners in the 1,000-pound and 1,000 to 2,000-pound classes for gasoline machines respectively.

The endurance run was a decided success, and showed very well what the modern automobile is capable of accomplishing in a gale of wind, while the one of last year demonstrated what it could do in a heavy rainstorm. It is to be hoped that the Automobile Club of America will have even better weather for its endurance run into Connecticut on May 30 and its speed trials on Staten Island the following day.

SCIENCE NOTES.

A new species of violet has been discovered by Miss Lillie Angell, of Minton Place, Orange, and Charles Louis Pollard, curator of plants at the Smithsonian Institution, has named the species *Viola angellæ*, after the discoverer. The leaves are cordate-ovate in outline, with a broad sinus, irregularly five to seven lobed, or some of them merely deeply sinuate. The lobes are all obtuse, more or less crenate, and the flowers are violet-purple, darker at the base. The leaves attain large dimensions.

The captain of the steamship "Australia," which recently arrived at San Francisco from Tahiti, believes that he has rediscovered the outcroppings of an island very rich in phosphates. The existence of this island was reported by Dr. John de Graves, now of Honolulu, as far back as 1859, since which time it has been searched for by vessels of the government and private persons. Stormy weather prevented the captain of the "Australia" from making as thorough an investigation as he desired. The United States Coast Survey vessel "Albatross" has made several fruitless searches for this island. The captain of the "Australia" states that the approximate situation of the island is 18 deg. 56 min. north latitude and 136 deg. 10 min. east longitude.

According to W. Syniewski (Bot. Centralbl., 87, 408), the composition of pure starch is always perfectly uniform, with the empirical formula, $C_6H_{10}O_5$. The more resistant constituent, starch cellulose, is a reversion product subsequently formed from the dissolved starch. The substances formed by the action of boiling water or of KOH on starch-grains are a product of the hydrolytic splitting up of starch. The simplest of these is a substance with the composition, $C_{54}H_{96}O_{48}$, to which he proposes to give the name amylogen. He further suggests that the term dextrin should be limited to the products of the hydrolysis of starch (with the exception of the sugars); those which do not reduce Fehling's solution, and are colored indigo-blue by iodine, being amylodextrins.

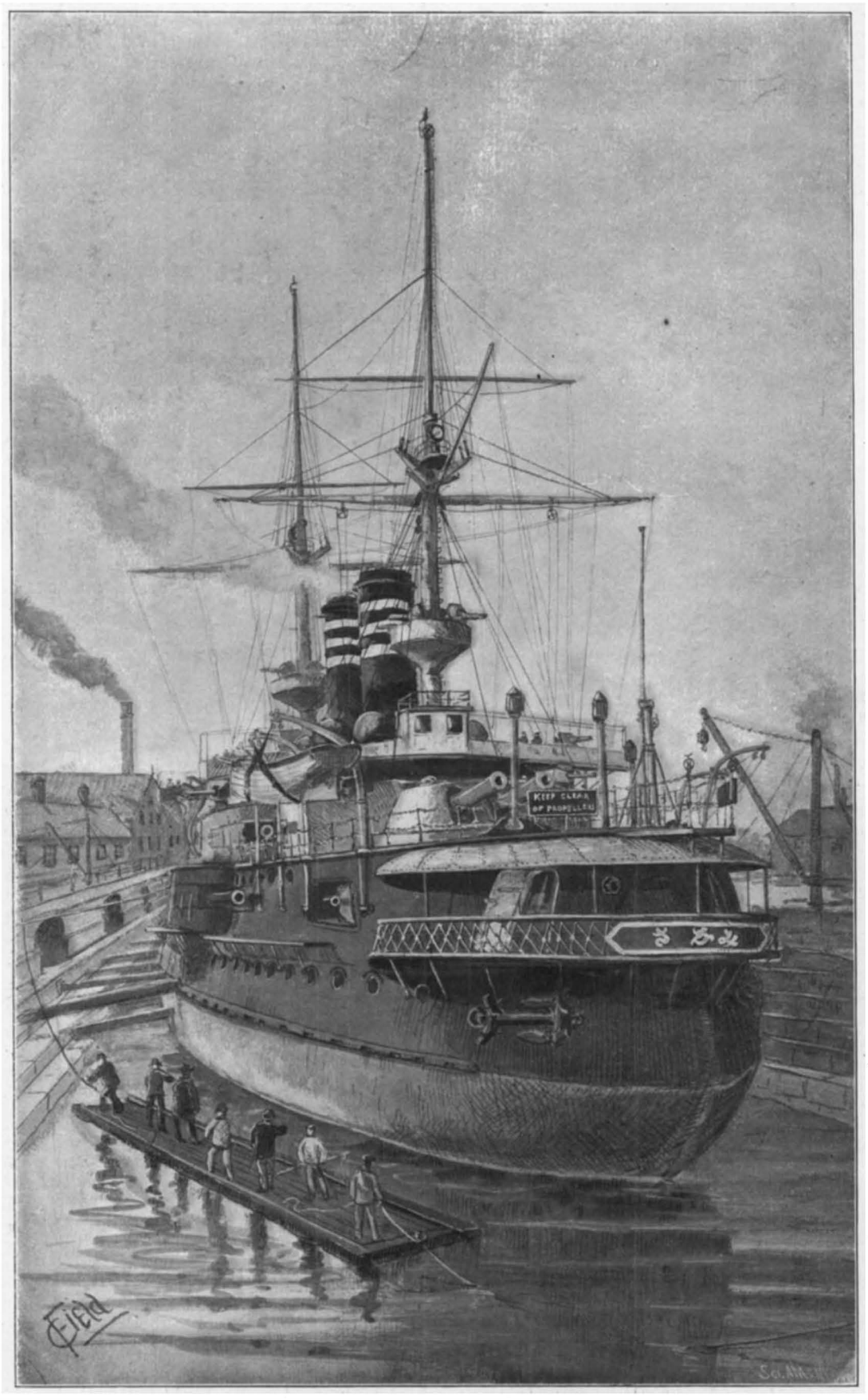
G. T. Beilby and G. G. Henderson have exposed platinum, gold, silver, copper, iron, nickel and cobalt to the action of ammonia at temperatures ranging from 400 deg. to 900 deg. In every case the physical effect of the treatment was to disintegrate the metal completely, while a large proportion of the ammonia was resolved into its elements. The fracture of metals which have been exposed to this action is spongy or cellular; under the microscope the metal appears as if it had been suddenly cooled while in a state of active effervescence. The penetration of the ammonia molecules into the metal is remarkably quick if the conditions are favorable. The authors believe that the physical effects which result from the action of ammonia upon metals at high temperatures are due to the alternate formation and dissociation of nitrides taking place between certain narrow limits of temperature, the reaction going in one direction or the other according as ammonia or hydrogen molecules preponderate in the gases which are in contact with the molecules of the metal at and below the surface. In several cases the formation of nitrides has been definitely proved. The absorption of small quantities of nitrogen by pure iron renders it hard and brittle like steel.—Proc. Chem. Soc.

THE NEW JAPANESE BATTLESHIP "MIKASA."

We present an illustration of the new Japanese battleship "Mikasa," the largest and, as many believe, the most perfect battleship in existence. The drawing represents the vessel in the naval dockyard at Portsmouth, where she was placed to have her bottom cleaned, preparatory to her official trial in Stokes Bay. The new warship is a mighty affair, bigger even than the "Good Hope," or the battleships "London" or "Vengeance," which, by the way, she rather closely resembles, although she is unquestionably a better protected and more powerful ship than they. Like all the new battleships of the Japanese navy, she was built in an English yard, having recently been turned out by the shipbuilding firm at Barrow. A sister ship, the "Asahi," was built at Clydebank; the "Shikishima," a battleship of about 14,850 tons displacement, was built on the Thames; the "Hatsuse," of 15,000 tons, at Elswick; and the "Fuji" and "Yashima," each of 12,320 tons, were built respectively on the Thames and by the Elswick firm. All of these fine ships are of 18 knots speed or over; the "Fuji," "Yashima" and the "Hatsuse" having made over 19 knots on trial. The displacement of the "Mikasa" is 15,200 tons.

One of the best features of this big vessel is the very complete way in which she is armored, particularly in respect to the protection afforded to the secondary battery. Unlike the vessels of the English navy and the English-built Japanese battleships "Fuji" and "Yashima," the "Mikasa" has her secondary battery protected by a continuous wall of side armor, a system of protection which we have always favored in our own navy. This affords a completely inclosed battery, and there is no danger of shells entering the battery through the unprotected stretches of the sides of the ship lying between armored casemates. The belt armor at the waterline is from 4 to 9 inches thick. Above that her lower deck is cuirassed by 9-inch plating with 14-inch fore-and-aft bulkheads. Her casemated battery is covered with 6-inch armor, her barbettes with 14 inches below and 8 inches over the guns, while she has in addition an armored deck which on the slopes is no less than 4 inches in thickness. So the "Mikasa" may well be said to be clad in "cap-à-pied" armor.

Her armament is not less imposing, consisting as it does of four long 12-inch guns, fourteen 6-inch and twenty 3-inch quick-firing cannon, twelve light rapid-fire guns and four submerged torpedo tubes. Nor must the formidable ram be forgotten, which is strengthened and stiffened—as is the case in the later English battleships—by the side armor being brought down so as to cover it entirely for some way back. In short, there will be no bigger or more powerful fighting ship in far eastern waters than the "Mikasa" when she arrives at her destination.



Displacement: 15,200 tons. **Speed:** 18 knots. **Armor:** belt, 4 to 9 inches; gun positions, 14 inches.
Armament: four 12-inch; fourteen 6-inch; twenty 3-inch; twelve smaller guns.

JAPANESE BATTLESHIP "MIKASA," RECENTLY COMPLETED AT BARROW, ENGLAND.

Genoa Electric Incline.

A very successful electric incline has been recently installed at Genoa. It starts from the Piazza Principe and has a length, measured on the horizontal, of 3,520 feet and the difference of level is 617 feet, giving a mean grade of 17 per cent. The line is single track with the exception of a crossing in the center. The rack-and-pinion system is used, the rack being in the middle of the track. The ties are supported on a strong masonry bed to prevent slipping. The cars are self-propelling and are arranged so that the platforms are horizontal when on the incline. The wheels are loose on the main axles and each axle carries in the center the large gear wheel which engages with the rack. This gear is operated by a direct current motor of 30 horse power working at 500 volts, which drives it by a set of reduction gearing. Each motor has a resistance-box on the roof and a rheostat under the car floor. The trolley system is used, with an overhead wire supported on pole-brackets. The car descends by its own weight and in this case the motor acts as a brake by becoming a generator. The controller, by varying the resistance, controls the descent at will. A special brake system is also provided for the descent and each car has two hand-brakes, in one of which a shoe is applied against a wheel placed on each axle, thus braking the gear-wheel of the rack, while the second is a band-brake upon a pulley placed on the armature shaft of each motor. The cars have a central compartment and two closed platforms and contain 30 persons in all. At each end is a small cabin, one for the motorman in front and the brakeman in the rear. In running, two cars are used, which start from each end and cross in the middle. The trip requires 14 minutes, with an average speed of 5.5 miles an hour and a maximum of 8. If need be the brakes can bring the car to a full stop, at the latter speed, within a distance of 3 feet. The electric outfit has been furnished by a Swiss company, the Compagnie de l'Industrie Electrique of Genoa.

Charles T. Schoen, of pressed steel car fame, announces that the pressed steel car wheel has demonstrated its utility by a severe test in actual service, and the new plant projected for the manufacture of the wheels will have an initial capacity of five hundred wheels per day.

Foreign Uses of Oil Fuel.

Early in February Consul Phillips, of Cardiff, received a letter from Galveston propounding certain queries as to the likelihood of oil fuel being introduced there. He replied as fully as he could at the time; but he has since made further investigations and now furnishes the results.

The consul ventures to prognosticate that this new combustible is destined ere long to revolutionize the coal markets of the world. The abnormal cost of steam coal in Great Britain—particularly in Wales—and the exorbitant price of the best house coal (£1 6s., or $6.50 per ton) are calculated to hasten this revolution.

An impetus was given to this industry five years ago, when petroleum discovered in Borneo was found to be well adapted for fuel purposes. This field is owned by the Shell Transport and Trading Company, Limited. Last year (1901) the exports exceeded 100,000 tons.

The Dutch Steamship Company uses this fuel in its boats; the Hamburg-American Line has built four new steamers adapted for oil fuel, and run them in the Eastern trade with marked success; the North German Lloyd has two local steamers using oil; the East Asiatic Company of Copenhagen, employs this fuel in its local boats, and is building two ocean-going steamers with the intention of using it; and the China Mutual is preparing three boats for the employment of oil.

The prejudice against oil fuel is passing away. Several firms are contemplating a change in their method of steam production, which they predict will be as safe as the old method and more economical. The advantages are said to be:

First. The saving of labor is large; there will be no ashes to hoist overboard after each watch; no need of stoking. All that will be necessary will be to watch the water in the boilers; the feeding of the fuel to the furnaces will be automatic.

Second. Fewer deck hands will be needed, as the dirt caused by coal shoveling will be done away with.

Third. Under proper combustion no smoke will be generated; every atom of oil is of calorific value; there is no residue.

Fourth. The fuel may be stored in the double bottom of a ship, the forepeak, afterpeak, and tanks under the engine room, thus occupying space not utilizable in any other way. No rust is possible where it is stored. The space now filled by coal bunkers is thus available for cargo; oil stores in a space of 35 feet per ton, as against 44 feet per ton of coal. The last results obtained show that Messrs. Thornycroft have evaporated 18.95 pounds of water per pound of oil in their torpedo-boat type of boiler, but in ordinary locomotive types 15 pounds of water per pound of oil is obtained.

Fifth. The oil fuel has a higher concentration of heat for manufacturing than can be obtained with coal.

Until recently oil fuel was held at a figure which did not enable it to compete with coal. A few months ago, however, oil in tremendous quantities was discovered in Texas, and the Shell Company found that it was capable of giving the same results as are derived from Borneo oil. An enormous expansion of its use may be expected.

The Great Eastern Railway, in this country, has already a large number of locomotives using this fuel. They say that by its use steam is more easily produced and is maintained up the steepest gradients, and great economy is effected by reducing the supply of oil when descending or remaining stationary; the life of the boilers is prolonged, inasmuch as the tubes do not foul; the nuisance of smoke and the danger of sparks to surrounding property are entirely ob-

viated, and the rolling stock generally is kept in a state of cleanliness which is impossible on a line where coal is used as a motive power.

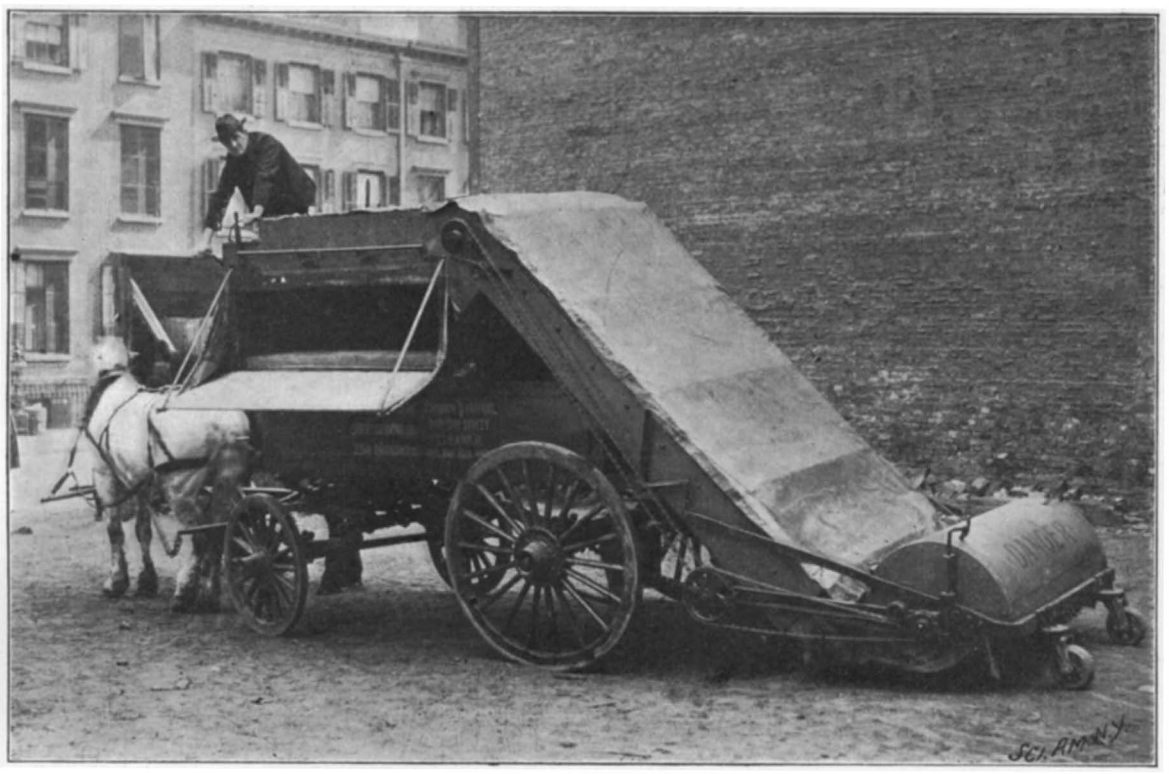
NEW SYSTEM OF STREET CLEANING.

Some of our readers, passing up Fifth Avenue recently, may have noticed the new street-cleaning device used on that thoroughfare. A clear understanding of the machine can be quickly had by a glance at the diagrammatic view shown herewith. The rotary sweeper, *A*, at the rear of the machine is operated by chains and sprockets from the hubs of the rear wheels, and serves to gather up and throw the dirt onto a slide, *B*. Moving over this platform is an endless belt, *C*, on which are a series of scrapers that carry the rubbish upward and forward until from the top of the slide it drops into the dust-proof box, *D*. In order to prevent the rubbish from accumulating at the rear end of this box and choking up the mouth of the elevator a conveyor, *E*, is provided, which moves the dirt toward the front of the box as soon as it has piled up within reach of the paddles on this belt. Both the elevator and the conveyor belts are driven by chain gearing from the rear wheels. A large water tank, *F*, is situated below the rubbish box and, under control of the driver, feeds the sprinkler, *G*, placed directly in front of the sweeper.

The advantages of this machine are evident. It does its work thoroughly and quickly without raising any dust; for the matter is first sprinkled and then raised through a covered elevator to a dust-proof receptacle. The whole operation is therefore under cover—a point which cannot be too strongly emphasized in any work which stirs up the heterogeneous filth of a city street. The machine holds two cubic yards of dirt, and the whole process of sprinkling, gathering and dumping can be controlled by a single man. The method of dumping the dirt is an interesting one. Referring again to the diagram we notice that the bottom of the rubbish-box is an endless sheet of iron which passes around rollers, *H*, placed along each side of the machine. These rollers are rotated by operating a lever at the driver's seat. Our engraving shows the door of the rubbish-box let down to form a chute for the dirt, and the driver may be seen operating the dumping lever.

By rotating the pulleys the floor is fed forward, forcing the rubbish out onto the chute, whence it slides into a dump-cart or any receptacle placed thereunder.

This machine should work a revolution in the present anti-



A SANITARY STREET-CLEANER.

quated methods of street cleaning. The slow, cumbersome operation of sweeping cobblestones by hand, aside from being expensive, is at the same time most unsanitary; for the rubbish is continually being stirred up

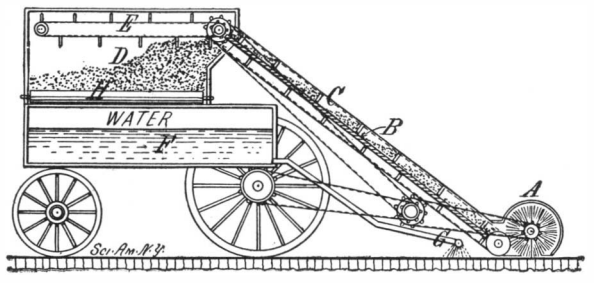


DIAGRAM OF THE STREET-CLEANER.

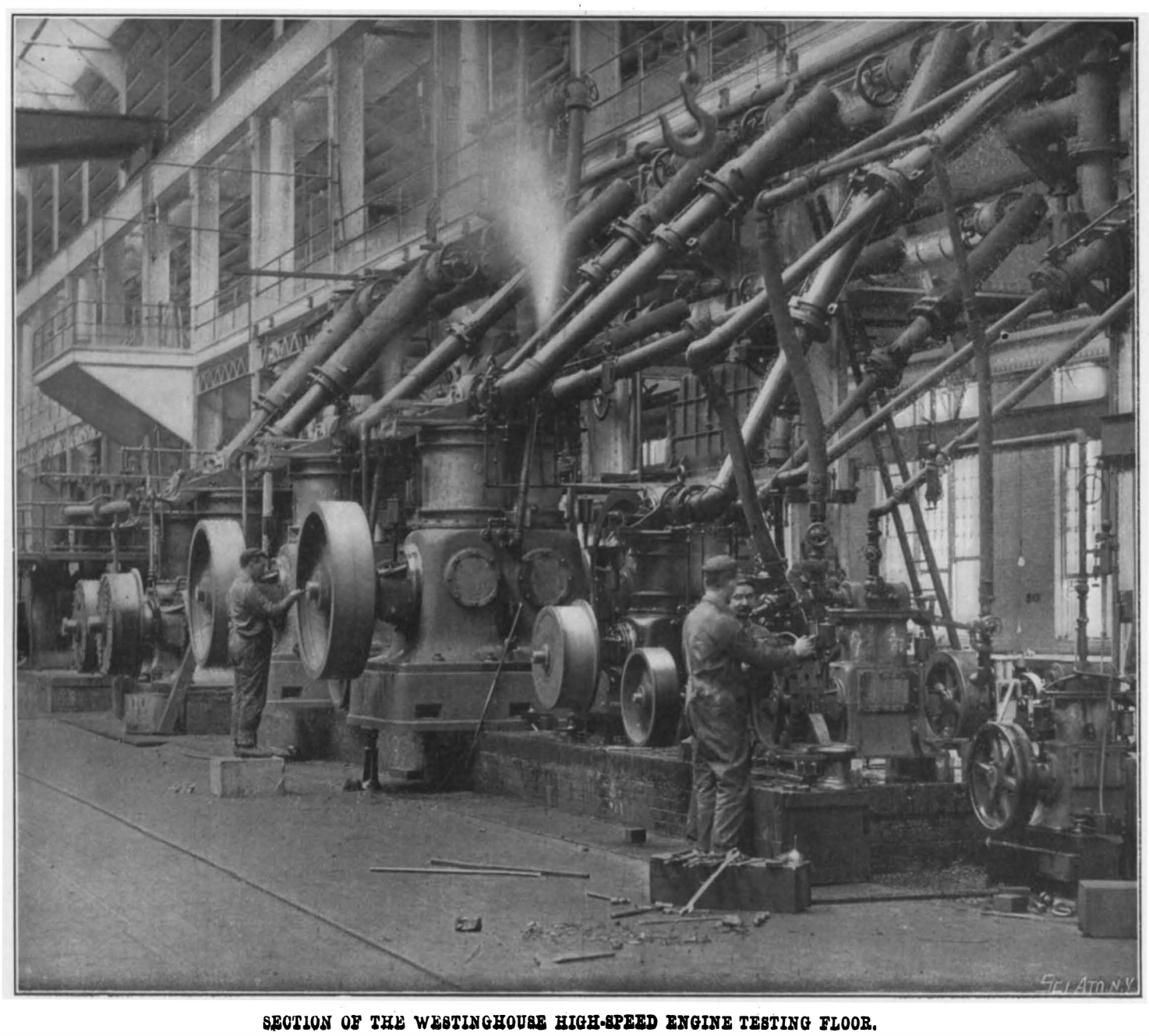
and laid open to the air, giving off bad odors. This machine, however, seems to fill all requirements; it sweeps on an average seventy thousand square yards of street per day at half the cost of hand labor and does the work without spreading any dust, odor or disease.

THE TESTING OF HIGH-SPEED ENGINES.

The testing room of the Westinghouse Machine Company's works is one of the most important and interesting features of the establishment. Extending down one side of the room is a long foundation bed, capped with plates which are slotted for holding-down bolts, which is capable of accommodating at one time as many as a dozen engines of sizes varying from 5 to 500 horse power. Above the testing bed, and at sufficient height to accommodate the larger engines, is a main steam pipe to which is connected a series of adjustable pipes, with swinging and extension joints. Behind the foundations are three surface condensers varying from 300 to 1,000 horse power capacity, while beneath each condenser, and mounted on platform scales, are two weighing tanks with suitable connections for delivering the water to one or the other, as desired. Each condenser is supplied with a vacuum pump, to enable the test to be made with the engine exhausting into a vacuum should a test of this nature be called for.

Every engine that is made in the Westinghouse shops is ultimately sent to the testing department, where it is set up and connected to steam and exhaust. A friction brake is put on the crankshaft and the engine is given a service test of from 20 to 60 hours, the duration depending upon the size of the engine. The object of this test is to regulate the governor and to develop any latent defects which might have escaped inspection at the erecting shops. When the run is ended the indicator is applied and the exhaust is turned into one of the surface condensers, the brake load and the steam pressure being maintained at a constant figure. This test is known as the duty test, its object being to determine steam consumption at rated load, and also at half and quarter load. During the test, indicator diagrams are taken, and the water coming from the condenser is weighed at frequent intervals and the results computed and entered on a record blank.

The system of testing is carried out with a view to determining both the steam consumption per indicated horse power and also the steam consumption per net or delivered horse power, the latter being the indicated horse power less the friction losses in the engine itself, and, therefore, the power actually available on the crankshaft. The tests as thus carried out are in no sense "laboratory tests." The conditions, moreover, are not



SECTION OF THE WESTINGHOUSE HIGH-SPEED ENGINE TESTING FLOOR.

by any means favorable to the engines. Thus, the boilers which supply the testing room are 150 feet away and are forced much above their normal rating, and as a result, the steam is far from dry. The adjustable piping, moreover, is uncovered and contains many valves and right-angle turns, the cylinders have no packing of any kind, and the piston rings and cylinders have not worn down to that smoothness which conduces to the best economy. Hence it has been found that the tests made at the time of delivery are in every case exceeded in results by tests taken after the engines have been delivered and have been for some time at work. The magnitude of the work carried on by the Westinghouse Machine Company may be judged from the fact that the work of the testing department involves the steady consumption of over 500 horse power of steam and the unremitting services of seven men, without including the fireroom labor and the work of pumping the water for cooling the brakes and for condensing. It is considered that the expenditure is fully justified, seeing that it relieves the company of all subsequent annoyance and expense in the way of correcting errors after the engine has been sent out.

Engineering Notes.

Dresden boasts of a novel method of heating its Royal Castle, Royal Opera House and Police Headquarters. The heat is conveyed through pipes. So great is the distance in some cases that the furnace is known in the town as the "long distance heating apparatus." It might seem that the loss of heat must be enormous, but reports received seem to indicate that the system works admirably.

A coal field in Asia Minor, situated in the northeast of the peninsula on the North Sea littoral, and about 140 miles from Constantinople, is being worked with some vigor, says The Engineer. The two principal ports of shipment are Heraclea and Zoungouldak. As a bunkering coal, an independent examination on behalf of the British Admiralty condemns it on account (1) of excessive clinkering, and (2) of a too high percentage of impurities to enable it to be used with advantage where a large amount of coal is required to be used per square foot of fire-grate. The quality tried for the British Admiralty contained 15 to 20 per cent of ash, and other qualities contain as much as 50 and 60 per cent.

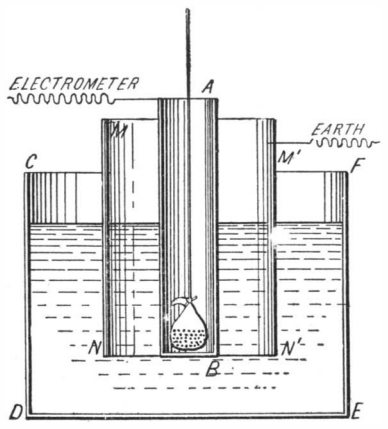
In some parts of the country no true coal exists, but lignite is found in greater or less quantities. Its heating value, as compared to coal is as 11 to 14, but it can be burned to advantage as fuel for steam boilers if the grates are made very large and correspondingly deep. There is a difference in the quality of lignite as in all other things, some of it being very wet. The heating surface should be not less than 40 to 1, or about what is used for anthracite. Lignite burns freely, being very light, and requires frequent firing, and, for that reason is very apt to be condemned by those who attend to that duty, but is no worse in this respect than soft coal screenings, of which quantities are used daily.

The loss of gold in the final tailings from a free-milling plant, with concentrating tables and either cyanide or chlorination treatment, is not a fixed value, says The Mining and Scientific Press. It varies with different ores and with different localities and cost of facilities. The effort to recover values stops short in every case at the point where the recovered value becomes equal to the cost of getting it. There are instances where it is less than 20 cents a ton, and claims have been made as low as 8 cents a ton, and again losses are recorded as unavoidable that are as high as $1.50 a ton. Anything over 50 cents a ton should be made the subject of a thorough questioning analysis before it is accepted as the acme of good milling practice.

In the year 1878 Dr. Flugge proved that air will go through the walls of a closed room, at a rate depending mainly on difference of temperature between the inside and the outside—the latter being the lower. With walls of ordinary thickness he found that about one-fourteenth of the air in the room would be changed per deg. C. per hour. In other words, if the outer were 14 deg. C. colder than the inner, the air of the room would be completely changed in an hour by transpiration through the walls. M. H. Wolpert has re-examined this subject, and he finds that in a chamber of 60 cubic yards capacity, having walls of masonry covered with paper, the air will be changed at the rate of one-fortieth of its volume per deg. C. per hour. When the paper on the walls contained oil-varnish decidedly less air permeated, while without paper at all much more went through. It is desirable, therefore, that the exterior of houses should be clean, and a heavy rain is a blessing in this respect. Also it follows that the greater the difference between inside and outside warmth the more copious this spontaneous ventilation. Pettenkofer found that when materials like slag and glass were used, through which air could not pass, the cements employed were, as a rule, highly permeable.

EXPERIMENTS OF M. CURIE.

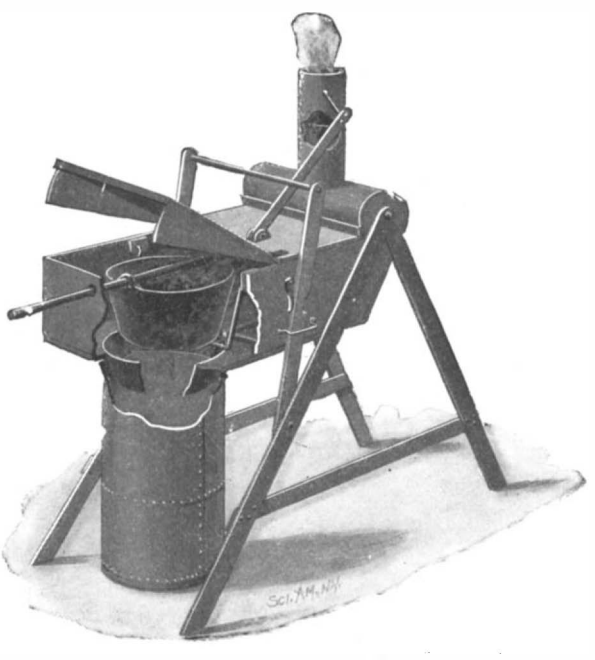
M. Curie has been making a series of experiments upon the action of radium rays and also of the X-rays upon various dielectrics. It has been already found that these rays increase the electrical conductivity of air and gases, and M. Curie now finds that they act in the same way upon liquid dielectrics. In the experiments which he describes before the Académie des Sciences he uses the arrangement shown in the diagram. The liquid to be experimented with is placed in a metallic vessel, *C D E F*, into which is plunged a thin copper tube, *A B*, and these two vessels act as electrodes. The outer vessel is kept at a constant potential by a storage battery, of which one pole is connected to earth. The tube, *A B*, is connected to an electrometer. When the current traverses the liquid, the electrometer is brought back to zero by an opposing potential, and this gives the means of measuring the current passing through the liquid. The copper tube, *M N*, *M′N′*, connected to earth, acts as a guard to prevent the current from passing across the air. The radium compound is placed in a small glass bulb at the bottom of the inner tube and its rays act upon the liquid after traversing the walls of the tube. To operate with X-rays, these are sent up from below against the bottom of the vessel, *D E*. In both cases all the liquid dielectrics seem to show an increase of conductivity when acted upon by the rays. When the action is observed with the above apparatus, but using air or gases, the intensity of the current is found to increase in proportion to the difference of potential between the electrodes when this reaches only a few volts, but as it continues to increase the current is no longer proportional, but seems to reach a limit, this being near 100 volts. On the contrary, with liquid dielectrics the effect is not the same, and the current remains always proportional to the tension between 0 and 450 volts, and even when the electrodes are not over 0.3 inch apart. Thus a given liquid may be said to possess a certain conductivity which is constant under these conditions, and may be measured. The following figures show some of the comparative figures: Carbon disulphide, 20; amylene, 14; chloride of carbon, 8; benzine, 4; liquid air, 1.3; vaseline oil, 1.6.



THE CURIE EXPERIMENT.

ASH-SIFTER.

An apparatus in which ashes may be sifted indoors without raising a dust in the room has been invented by Mr. G. J. Le Brake, No. 647 34th Street, Milwaukee, Wis. As shown in our illustration, the sifter comprises a trunk or body pivoted at the rear to a frame and resting at the front end, when in use, on an ashcan or bucket. Mounted within this body is a sling in which the sifter-pan is held. A handle on the sifter-pan extends through the end wall of the box, and may be operated to give the pan a reciprocating motion. Directly below the sifter-pan is a funnel or spout which extends through the floor of the body, and fits tightly into the ash-can below when the apparatus is in operative position. At the rear end of the body is a pipe which may be connected to the flue or chimney of the house and through which the dust can escape. A damper in this chimney is connected by a lever to the body of the sifter, so that when the latter is in its operable position the damper is open and permits free escape of the dust, but when the body is raised the damper is closed and prevents a current of air from passing unnecessarily through the apparatus. The body is raised and held in its upper position to permit of readily removing the ash-pan after the ashes have been sifted. Two levers pivoted to the frame, one at each side of the body, and connected by a bar at the top, serve to hold the apparatus in this raised position, a notch in each lever supporting a keeper on the body. The notched edges of the levers are kept by spring tension into contact with the keepers.



A DUSTLESS ASH-SIFTER.

When it is desired to use the apparatus, an ashcan is placed in proper position under the funnel, and then a forward pull on the supporting levers permits the body to drop and wedge the funnel into the mouth of the ashcan. At the same time the damper is automatically opened, permitting a current of air to carry up the chimney all dust arising from the ashes as they are poured into the sifter-pan. As soon as this has been done, the cover of the box is closed and secured, after which the handle can be operated to sift the ashes without the slightest danger from dust and dirt. The wing-like side pieces on the cover are adapted to lie against the sides of the body and insure a perfect connection between the lid and the trunk.

New York's Crematory for Light Refuse.

It will be remembered that the late Col. George Waring was a strong advocate of the disposal of city refuse by incineration, and that he had even gone so far as to build an experimental plant in which the city's garbage was to be burned. The idea has been again taken up by Dr. Woodbury, the present Commissioner of Street Cleaning, who has commissioned Mr. H. de B. Parsons, of New York city, to prepare plans for a raffle incinerator, which is nothing more or less than a crematory for the burning of light refuse.

Mr. Parsons' plans have been completed, submitted to the Commissioner, and approved. The result is that an experimental crematory built in accordance with these plans will soon be erected.

At present New York's light refuse is carted to docks, is there loaded on scows and towed out to sea, together with garbage and ashes. This light refuse, composed chiefly of boxes, mattresses, waste paper and the like, is disposed of at a certain price per yard. By burning this material it is hoped to effect a very considerable saving.

The plant will be erected at the foot of West Forty-seventh Street. The carts containing the light refuse will dump their loads into hoppers closed by counterbalanced doors. From the hoppers the refuse passes from a ledge to a drying table back of the grates. Here the material is partially dried by heat. The next stage in the process is to convey this dried material to the fires.

Three fire-boxes are provided. The refuse is not to be discharged into the furnace simultaneously, but onto one grate at a time. In this manner it is possible for the gases of combustion from one grate to mingle with those of a hotter furnace. The products of combustion, having passed through the length of three grates, are conveyed back to the furnace to a point beneath the drying table, where they are utilized in drying the refuse that comes from the hoppers. From beneath the drying tables the gases may be discharged directly to a 114-foot stack or else beneath vertical boilers near the stack.

The plant is to be regarded simply in the light of an experiment. Its primary purpose is to show that it is cheaper to burn light refuse than to dispose of it otherwise, and that a crematory can be maintained within the city limits without in any way becoming a nuisance.

The Current Supplement.

The first article of the current Supplement, No. 1375, is a handsomely illustrated description of the New York Zoological Garden. Mr. John Hughes discusses very thoroughly the subject of the utility of alkaline phosphatic manure. Just now the metric system is very much the subject of Congressional interest. For that reason the report of the committee on the bill providing for the adoption of the metric system by the government of the United States should be of interest. The report will be found in the Supplement. Prof. Henri Moissan tells something of a new treatment of niobite and of the preparation and properties of cast niobium. The interesting description of electric furnaces begun in the last issue of the Supplement is concluded. Mr. E. C. Handy explains from the electro-chemical standpoint the use of cadmium in testing storage batteries. The usual Consular Notes and Selected Formulæ are published.

A NEW MEANS OF USING COMPRESSED AIR IN THE MANUFACTURE OF GLASSWARE.

In the production of hollow glass vessels there have always been two obstacles which from time immemorial have very seriously hampered the glass-blower. Of these obstacles, the first is that the inlet opening of the hollow vessel can never be larger than the end of the blowpipe. The second is that the hollow vessel thus produced can never be greater than the volume of air which a strong man can blow through the pipe, or the mass of glass which he can conveniently handle. The first obstacle has been partially, though indifferently, overcome by subsequent reheating and manipulation. By spurting water through his blowpipe, the glass-blower has succeeded in producing fairly large receptacles, for the expansive force of the steam generated assists the air from his lungs. But despite these ingenious makeshifts it has not been possible to blow a glass receptacle larger than a carboy having a capacity of 25 gallons.

Since the glass-blower's lungs have but a limited power, it was but natural that inventors hit upon the idea of employing compressed air. Philip Arbogast, of Pittsburg, as early as 1881 took out a patent for an invention which contemplated the use of compressed air and which has served as a foundation for subsequent attempts. But although compressed air has been widely employed in the manufacture of certain articles, it has never supplanted the human glass blower, particularly in the making of large receptacles.

A German inventor, Paul T. Sievert, now comes to the fore with a process that bids fair to solve the problem of blowing large vessels and overcoming the difficulties which have hitherto baffled the glass manufacturer. By means of this new process vessels varying in size and shape from the tiniest watch-glass to the largest bath-tub can be blown with a facility which has never been hitherto attained. That the Sievert process is capable of fulfilling these claims is clearly shown in the sixth of our figures. All the vessels pictured in the illustration were completely blown without any subsequent grinding or cutting. The time in which these receptacles were made is almost incredible. The production of the bath-tub was a matter of not more than five minutes. Several days in the cooling oven were, however, still required before the tub was ready for use. Moreover, the process of making these vessels is singularly clean. No rubbish heap of broken glass is to be seen anywhere in the Sievert plant in Dresden.

The means by which glass is blown into pots and tubs of any size will be best understood by reference to Figs. 1, 2, 3, and 4, representing the various stages in the blowing process. The apparatus employed consists of a thick, perforated cast-iron plate having the form of the opening of the tub to be produced. On the raised margin of the plate a separable frame is placed, held in position by locking-levers, which frame serves the purpose of confining the outer edge of the glass mass within the limits of the cast-iron plate. The combined plate and frame are mounted on a hollow shaft, journaled in suitable bearings and arranged to turn. By means of the hollow shaft and the perforated iron plate, compressed air can be forced into the molten glass. From a ladle suspended from a traveling-crane a sufficient quantity of molten glass is poured on the iron plate. Our first figure represents this stage.

The liquid glass flows over the entire plate and beneath the superposed frame surrounding the plate. Since the metal cools more rapidly at the margin, the glass begins to congeal and stiffen first at its outer edge. When this marginal rigidity has been reached, the entire plate and frame is turned through a half circle. Fig. 2 shows the plate as it is describing its half turn. The glass lies on the plate in a smooth, glittering layer. It is still hot, but not self-luminous; and for that reason its color is black in our pictures.

The glass no longer rests on the plate, but hangs therefrom, supported by the chilled and now rigid outer edge. But the central portion being still ductile and plastic begins to sink. In order that the glass may thus fall uniformly throughout its mass, a bed-plate, operated by rack-and-pinion and a chain-gear, is brought into contact with the slowly sinking bag of plastic glass. Upon this bed the glass spreads and forms the bottom of the tub. Fig. 3 pictures this stage of the process.

By allowing the bed to fall slightly the glass is pulled down and the walls of the tub formed. The glass has become cool and tough by this time. Through the hollow shaft and the perforated iron plate compressed air is now forced into the forming tub, the operator so controlling the current that the tub's walls can be given any inclination. When the tub has been given the desired form the air blast is cut off.

In order to release the finished tub from the perforated iron plate the parts of the superposed frame (now, however, located beneath the plate) are separated by means of the levers previously mentioned; the bed is allowed to descend still further; and the finished bath-tub, rigid, though still hot, is liberated from the grip of the frame and iron plate. Fig. 4 shows the completed product. The hot glass tub is now hauled on a cart to a cooling oven.

In exactly the same manner a glass receptacle of any size or shape can be blown. The weight of the plastic mass is no longer a hindrance to the glass-blower; it is even utilized in the production of the finished product.

The Sievert process is not limited to the making of pots, trays, tubs, bottles, and like utensils. It seems destined to have no small influence on our methods of making plate-glass. From the recent articles which have appeared in the SCIENTIFIC AMERICAN, our readers will understand that the window-glass which we employ is rolled out and then polished. Herr Sievert, however, intends to dispense with all rolling machinery and to blow his plate very much as he blows his bath-tubs and pots. So far as we are at present informed two methods are pursued in blowing plate glass, which methods are respectively pictured in Figs. 5 and 7.

The first of these methods consists in blowing a cylinder (Fig. 5) after the manner previously described; in allowing this cylinder to cool; in cutting it lengthwise into two parts and severing the bottom from the body; and in causing these severed portions to flatten into plates by the application of heat. The second of these methods (Fig. 7) consists in blowing glass into the form of a huge box by means of a cubical mold and in breaking away the five plates formed by the bottom and sides. Fig. 7 shows the box in process of formation and represents a gigantic bubble of glass 4 feet high and 5 feet wide, the thickness of the walls being somewhat more than one-tenth of an inch.

Although the Sievert process can be followed in blowing all kinds of receptacles, it is found in actual practice in the making of small utensils that the glass chills too quickly to be blown into shape. Another method has, therefore, been devised no less ingenious than the first.

We all know that a drop of water that has fallen upon a hot object—a stove, a glowing sheet of glass—does not come in contact with the hot surface, for the reason that it is buoyed up by a cushion of vapor. Nor does the drop boil rapidly away. It is slowly converted into steam and then gradually disappears. This "caloric paradox," as it is sometimes called by physicists, is profitably employed by the glass-blower; for, the water does not cause the glass to crack, and generates enough steam to assist in expanding the vessel at the end of the blow-pipe. Upon the same phenomenon Herr Sievert bases his method of forming small glass utensils, reversing it, however, by placing his hot glass on a layer of water instead of blowing water into his hot glass.

In order to make a developing tray such as every photographer uses, very hot and therefore very liquid glass is poured on a sheet of wet blotting-paper. The glass does not touch the paper, does not even scorch it, but dances on the wet surface as it flows in all directions. By means of a wet roller, such as every housewife uses in flattening dough, the glowing mass is distributed evenly in a thin layer. The plate thus formed is lifted with a pair of tongs and laid on a sheet of wet asbestos upon which it still continues to dance. Upon the plastic plate a mold of the tray to be produced is then placed. The steam generated, which is the cause of the restlessness of the plate, then forces the plastic mass up into the mold. The tray is finished. And thus it is possible to produce a glass vessel of any shape whatever.

Zeppelin Ruined by His Airship.

Count von Zeppelin, who has the distinction of having built the largest of all airships, has been financially ruined by his aeronautical experiments. Unable to obtain means for carrying out his new projects, he is now breaking up the old framework of his airships in order to sell the aluminium of which they are composed. Zeppelin is sixty-seven years of age. He is something of a historical personage. He was military attaché of the German Embassy during the civil war, and made several balloon ascensions from battlefields of the South in 1863. He was the leader of the famous cavalry raid into France in 1870 which marked the commencement of hostilities of the great Franco-Prussian war.

Austria Adopts the Braun Wireless Telegraphy System.

It is announced that Siemens & Halske, the owners of the Braun patents, have signed a contract with the Austrian government for the installation of the Braun system of wireless telegraphy on the Adriatic coast.

Several designs of hods are now made of steel, and they are said to be much lighter and more serviceable than those of wood. These are pressed out of a single piece of metal, which fact is said to account for their great durability.

Correspondence.

That Frozen Mammoth.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest in your issue of April 12, the note on the recent discovery of the body of a mammoth, in cold storage, by Dr. Herz in the ice-bound region of Eastern Siberia. This, it seems to me, is more than a "Rosetta Stone" in the path of the geologist. It offers the strongest testimony in support of the claim that all the glacial epochs and all the deluges the earth ever saw, were caused by the progressive and successive decline of primitive earth-vapors, lingering about our planet as the cloud vapors of the planets Jupiter and Saturn linger about those bodies to-day.

Allow me to suggest to my brother geologists that remnants of the terrestial watery vapors may have revolved about the earth as a Jupiter-like canopy, even down to very recent geologic times. Such vapors must fall chiefly in polar lands, through the channel of least resistance and greatest attraction, and certainly as vast avalanches of tellurio-cosmic snows. Then, too, such a canopy, or world-roof, must have tempered the climate up to the poles and thus afforded pasturage to the mammoth and his congeners of the Arctic world—making a greenhouse earth under a greenhouse roof. If this be admitted, we can place no limits to the magnitude and efficiency of canopy avalanches to desolate a world of exuberant life. It seems that Dr. Herz's mammoth, like many others found buried in glacier ice, with their food undigested in their stomachs, proves that it was suddenly overtaken with a crushing fall of snow. In this case, with grass in its mouth unmasticated, it tells an unerring tale of death in a snowy grave. If this be conceded, we have what may have been an all-competent *source of glacial snows*, and we may gladly escape the unphilosophic alternative that the earth grew cold in order to get its casement of snow, while, as I see it, it *got its snows and grew cold.*

During the igneous age the oceans went to the skies, along with a measureless fund of mineral and metallic sublimations; and if we concede these vapors formed into an annular system, and returned during the ages in grand installments, some of them lingering even down to the age of man, we may explain many things that are dark and perplexing to-day.

As far back as 1874 I published some of these thoughts in pamphlet form, and it is with the hope that the thinkers of this twentieth century will look after them that I again call up the "Canopy Theory."

ISAAC N. VAIL.

Pasadena, Cal., April 16, 1902.

Crossing the Sahara by Balloon.

The aeronautical problem which is just now receiving most attention in France is a voyage across the great desert of Sahara. M. Deburaux considers it absolutely practicable to travel from Tunis to the Niger by means of the winds traveling in that region. He declares himself ready to make the experiment. Up to the present time his ambition has remained unrealized, for the reason that the necessary funds have not been forthcoming. To construct and equip a balloon with a carrying capacity of several passengers would entail a cost of about $160,000. For economical reasons the plan has been advocated of sending up an experimental balloon controlled by automatic devices. The expense involved in this undertaking would be only about $4,000.

The equilibrium of this experimental balloon is to be maintained by means of a steel cable weighing half a ton. Ballast in the shape of 5,000 pounds of water is carried in the tank. Automatic means are provided to discharge this ballast when the balloon falls to within 150 feet of the ground. The balloonette, which has figured so prominently in the Santos-Dumont airship, will be used to keep the gas bag in shape, in spite of the leakage of gas. Prof. Deburaux believes that the nomadic tribes of the desert, who might pick up this balloon, would probably convey the information of their find to civilization. But whether the nomads of the desert are sufficiently imbued with the scientific spirit, is a matter of some doubt. Perhaps a better plan would be to offer a reward for the return of the balloon or of some account of its fate.

St. Louis Airship Races.

The conditions of the races for the capital prize of $100,000, offered by the World's Fair management have been published. Tentative rules for the time of the races, shape of course, type of airship, and the like have been drawn up. It has been definitely decided that $200,000 shall be appropriated for the contest, to be divided as follows: $100,000 for a grand capital prize; $50,000 to be divided into a number of subsidiary prizes; and $50,000 devoted to the conduct of the competition and the payment of general expenses.

The Chemistry of Confectionery.

An interesting lecture was recently delivered before the Society of Arts in London by Mr. William Jago upon "Chemistry of Confectionery." In flour confections or cakes—not sugar confections or sweets proper—the principal substances used are flour, milk, eggs, and sugar. For confectionery the weaker and softer flours, containing much starch and little gluten, are preferable. Milk is used as a moistener instead of water, because of its richness, average pure new milk containing 4.0 per cent of fat, 3.6 per cent proteids, 4.5 per cent sugar, 0.7 per cent ash, 8.8 per cent non-fatty solids, and 78.4 per cent of water. It is not only the fat in the milk that is of service to the confectioner, but also its proteids, which, though like the white of eggs have no very pronounced taste, yet confer a fullness of flavor which a simple solution of lactose in water would not possess. In baked goods the proteids of milk produce a moistness and mellowness of character, and new milk therefore gives to confectionery richness through its fat, sweetness through its sugar, and mellowness through its proteid.

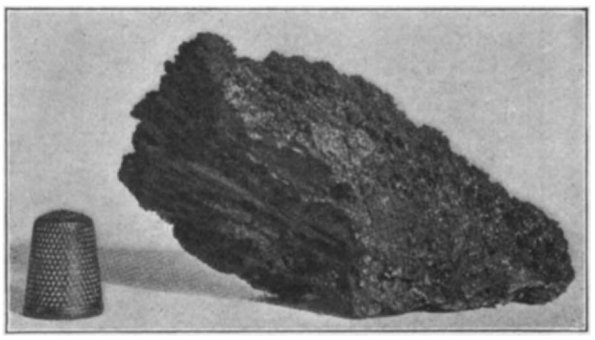
Next to milk, eggs are one of the most important moistening agents to the confectioner. In composition the white of eggs consists of proteids dissolved in water, while the yolk contains in addition to the proteid, fat and coloring matter. The white of eggs may be viewed as a solution of one part albumen in seven parts of water, while in the whole egg about two-fifths of the solids consist of fat and three-fifths of proteid, while the water of the whole egg amounts roughly to three-quarters of its weight. Another moistening agent used by confectioners is glycerin. If exposed to the air glycerin increases in volume through absorption of moisture. Chemically glycerin is a compound of carbon, hydrogen, and oxygen, belonging to the alcohol type. When used in small quantities in cakes the result is that drying is much retarded and the cake remains fresh and moist for a considerable time longer than would otherwise be the case.

Many aerating agents are used by confectioners, the chief of them being ammonium-carbonate, usually called "ammonia," or volatile sodium bicarbonate, tartaric acid, and cream of tartar. The chemical action of these on the confectioner's paste is to change the sugar present by fermentation into alcohol and carbon-dioxide gas, which has the mechanical effect of distending and lightening the dough. If, for instance, ammonium carbonate be mixed with other constituents of a dough, there is very little change perceptible until the dough is placed in the oven. With a rising temperature the liberated carbon dioxide and ammonia gases distend the mass and so produce the desired lightness. Like ammonium carbonate, sodium bicarbonate only commences to evolve gas when subjected to the heat of the oven, and even then it only evolves half its gas. When, however, it is treated with an acid the whole of the carbon dioxide gas is evolved, and of all acids the most convenient for this purpose is tartaric acid. When tartaric acid and sodium bicarbonate are mixed with flour in equivalent quantities, the result by moistening with water is that the acid attacks the carbonate, liberating all its carbon dioxide and forming normal sodium tartrate. The latter salt is comparatively tasteless, and the presence of the quantity produced as a residue from the amount of acid and soda necessary for the aeration of an average dough is not sufficient to injuriously affect the flavor of the resultant goods.

The British Admiralty has been carrying out a series of important armor-plate tests at the Whale Island butts, Portsmouth, for the first time with the 2-inch armor plates used in protective decks, and intended to form the splinter screens behind the guns in the central battery of the new 16,500-ton battleships. Plates from all the armor works were tested. The manufacturers were not on this occasion called upon to submit special sample plates. The Admiralty used those plates which they had already bought for the splinter screens. The results were highly satisfactory.

LONDON SMOKE DEPOSITS.

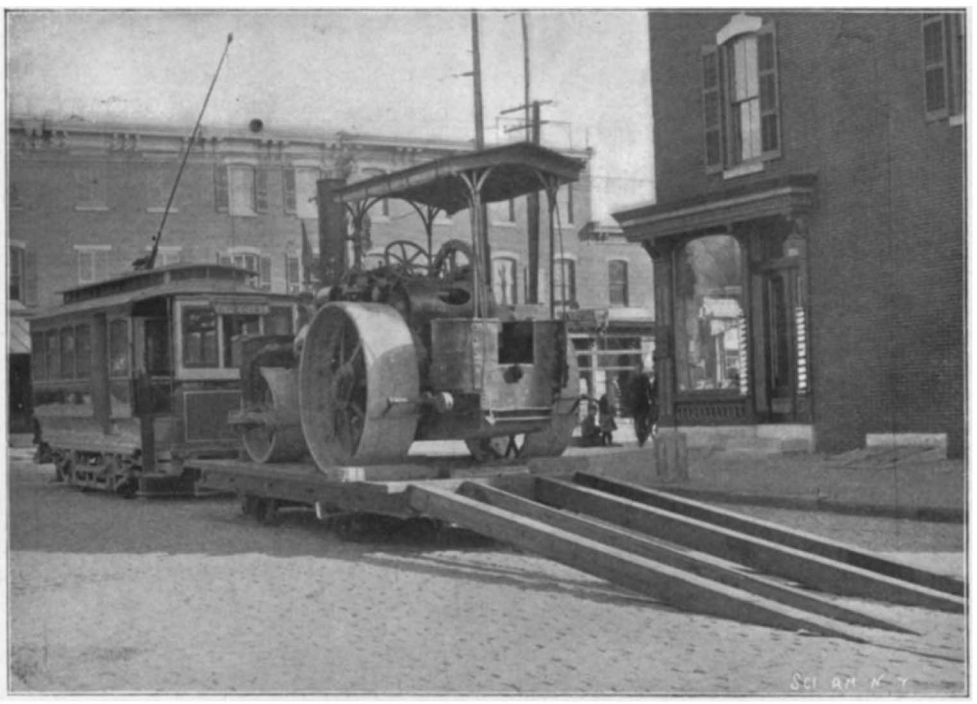
Of late years a great deal of attention has been drawn to the question of London smoke, and during the recent great fogs in that city, a number of experiments were conducted by Sir William Thistleton-Dyer, which showed that solid matter, consisting of soot and tarry hydrocarbons, was deposited during the worst fogs at the rate of so many tons to the square mile every week.



The size of the mass is shown by comparison with the thimble.

SMOKE DEPOSIT FROM ST. PAUL'S CATHEDRAL.

The fogs of the Thames Valley can, of course, never be avoided; but that particular quality of fog which takes its distinctive name from the great city itself could be prevented if its citizens were willing to use smokeless coal in place of the highly bituminous coal which they favor at the present time. There is a society in London known as the Coal-Smoke Abatement Society that has strenuously grappled since 1898 with the problem, and with the very best results. At a recent meeting of the Society, Prof. A. H. Church exhibited a specimen of a remarkable atmospheric deposit, which had been taken from the cornice below the dome of St. Paul's Cathedral. It is believed that this specimen, which is herewith illustrated, had taken about two hundred years to form. According to the Illustrated London News, to which we are indebted for our illustration, the mass contains one grain of carbon per 100 grains, and about half a grain of tarry matter in the same weight of deposit. The chief constituent is gypsum or crystallized sulphate of lime, produced by the action of the sulphuric acid of the city atmosphere on the carbonate of lime of the stone of which St. Paul's is built. This sulphate of lime is first dissolved by, and then deposited from the rain water. During the formation of the coral-like mass, the tarry particles of soot are inclosed within it. In order to give an idea of the size of the piece, an ordinary thimble is shown beside it in the illustration.



STREET ROLLER READY FOR TRANSPORTATION.

PORTABLE WELDING MACHINE, WITH ASBESTOS SCREEN FOR PROTECTING OVERHEAD WORK.

NOVEL USES FOR THE TROLLEY CURRENT.

BY DAY ALLEN WILLEY.

In making repairs and building extensions to its system the Union Traction Company, of Philadelphia, has in service an interesting variety of apparatus, most of which is operated by the current from the trolley wire. The company makes use of welded track joints, and for making the joints they use a portable welder, which is mounted upon a truck especially built for the purpose. The cupola has a capacity of about 1,800 pounds of iron. The blower mechanism is operated by a five horse power motor, carried on the center of the truck, which also has space for fuel, tools, etc. Two men only are required to operate it. To avoid the danger of melting the overhead construction by the heat from the cupola, a screen of asbestos, mounted on framework, is placed below the trolley wire.

For breaking joints and pigs of iron for the cupola a drop hammer has been designed, which is also mounted on a special truck, but is hauled by another car. The hammer proper weighs 1,500 pounds and has a fall of 16 feet, giving it sufficient force to break the heaviest joint in service. The winch is operated by an ordinary railway motor, and the mechanism, as will be noted, can be readily operated by one man. For supplying illumination for repair work, Mr. H. B. Nicholls, the maintenance-of-way engineer, has devised among other appliances some portable street lamps, which are connected with the overhead wiring by what is known as the fishpole circuit. The poles sustaining the wiring are merely hung to the trolley wire, so that they can be lifted off instantly to allow a car to pass, then replaced without delay. The lamps, which are of the incandescent type, are arranged in series of ten each, and furnish ample illumination for the most intricate repair work.

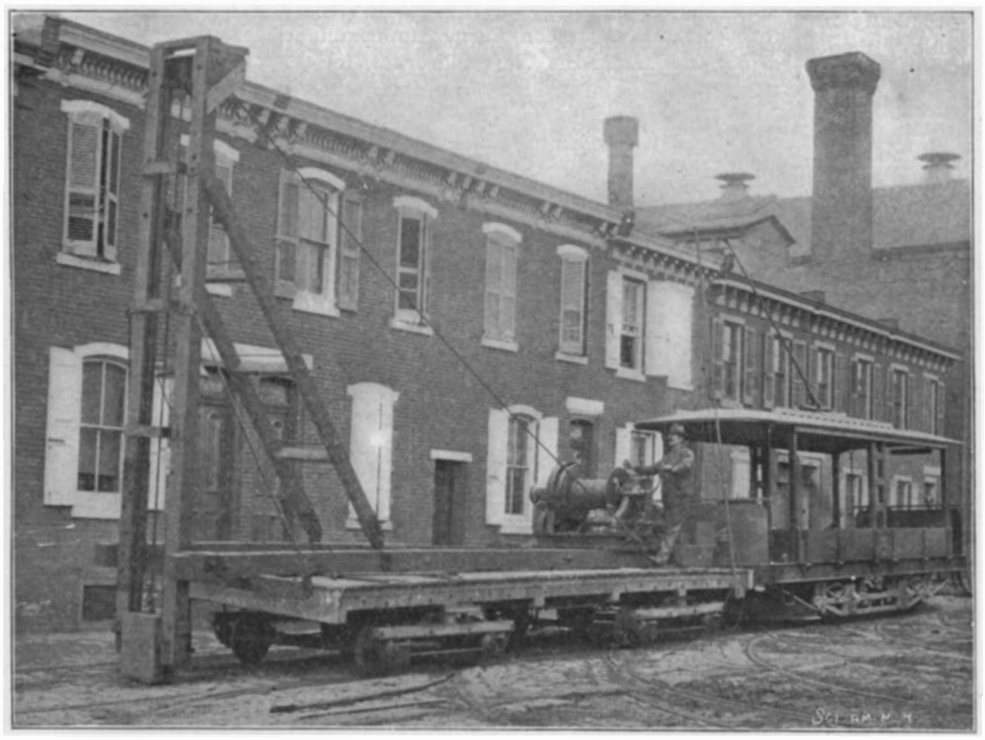
Another appliance which is of much practical value is the rail grinder, which is utilized for smoothing the welded joints. It consists of an emery wheel, driven by a two horse power motor which is placed on a barrow. It is carried on a motor car to the locality where it is to be operated, when a workman merely trundles the barrow to the joint. The motor is first connected to the trolley wire, then by a flexible shaft with the emery wheel, which polishes the joint in a few minutes. The current is then disconnected and the motor wheel backed to the car and taken wherever its services may be needed.

The charter of the company requires it to keep a certain portion of the pavement of the streets traversed by its lines in good repair. For surfacing the macadam and asphalt it employs a 15-ton road roller, which is transported by electric motor power on a flat car especially built for the purpose. On arriving at the street where the work is to be done, a detachable inclined platform is fastened to the end of the roller car, and the roller easily transferred to the surface. It can be loaded again by its own power. It is about the only special application in which steam is used in repair or other work by the company. Even in the system employed of greasing the curves, a large number of men have been dispensed with by the use of what the engineer poetically terms "grease chariots." These consist merely of small carts drawn by one horse, the greaser standing on a low rear platform. Each chariot is equipped with a broom, a crowbar for removing stones and other obstacles from the switches, a pail of grease, and swabs.

Another valuable addition to the company's equipment is a portable sand-blast apparatus. This is also hauled by horse power, and consists of an air compressor driven by an electric motor which takes current from the trolley wire. The work of cleaning the

rails and joints, where necessary, is quickly and thoroughly done by the application of the sand blast.

By drawing upon the trolley current for the variety of purposes above outlined, the company, as may be imagined, has been able to cut down its payroll considerably, and yet keep its system up to a high standard of efficiency. Engineer Nicholls and his assistant, not satisfied with the ordinary method of track welding, are now experimenting with the use of zinc for the rail joint, and the success which has attended their efforts will probably result in this metal being substituted for pig iron.



ELECTRIC PILE DRIVER FOR BREAKING RAIL JOINTS.

How Jugs Are Made.

BY THOMAS C. HARRIS.

Among the arts and crafts known to man there is probably none older than the making of pottery of some sort. Fragments of rude pottery are found among the remains of prehistoric man everywhere and some of them appear to have been made by machinery, other than the hands alone.

The old-time potter's wheel, of the time of Moses, may still be found in use in some parts of the Southern States, notably in the middle counties of North Carolina.

To any one accustomed to large manufactories, with special machines for turning out certain articles rapidly and cheaply, the hand-made methods of a hundred years ago would be curious and interesting.

A visit to one of the backwoods "jug factories," where the primitive potter's wheel, run by foot power, is still in use, would suggest to the modern mechanic that the wheel of time had slipped a cog and that that part of the world had gone back several centuries. When a boy, the writer was told that the molasses and vinegar jugs were made by plastering a layer of clay over a coil of rope which was afterward removed by uncoiling and withdrawing it through the mouth of the jug. Such a method would, of course, be impracticable.

The jug maker at one of these rude "factories" is frequently a small farmer, who devotes his spare time to the pottery business. Using the clay from his own farm, he employs no help, doing everything with his own hands, and cares nothing for strikes, freight rates or labor agitators. The product of his wheel is sold for so much per gallon in his immediate vicinity, or the country towns where he takes it for sale in his own wagon.

Under a rude shed the potter sits astride a rough bench while he revolves the wheel with one foot. To make the seat more comfortable he often uses an old saddle to sit upon. In front of him is a horizontal wheel or disk of heavy boards, revolving in a shallow box of wood. The wheel is carried on the upper end of an upright shaft with a heavier wheel on the same shaft, but near the ground. The lower wheel serves only to keep up a steady motion imparted to it by the movement or sidewise thrust of his foot on the swinging foot lever.

The foot power is simplicity itself. The foot lever is a stick or rod of wood with a pivot or peg at its outer end, while the end next to the operator is suspended to the bench by a piece of rope or chain. A short piece of wood connects the crank in the vertical shaft to the foot lever, and the side-way movement of the lever keeps the wheel in motion.

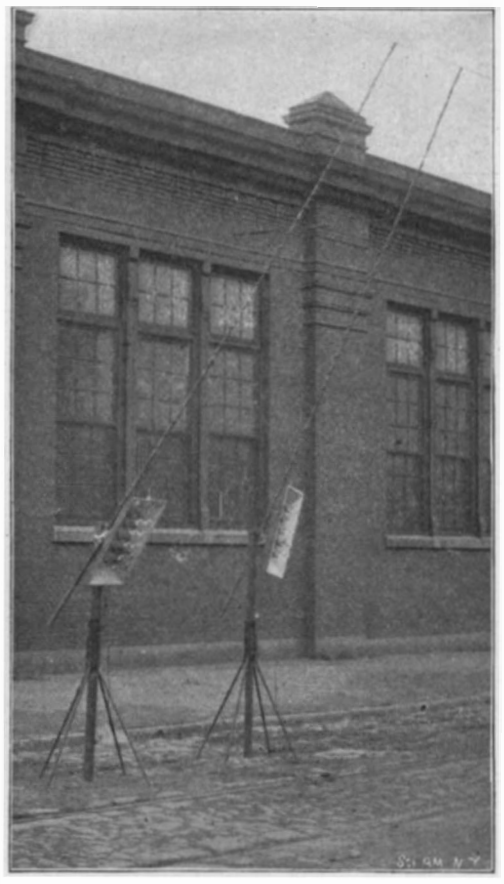
Having previously tempered his clay from the clay pit, he divides it into lumps of the proper weight for a jug of a certain size. One of these plastic lumps is placed on the center of the revolving disk and the potter proceeds to give it form and shape, mainly by the manipulation of his hands alone. It is interesting to watch the soft clay grow into symmetrical shape under the simple manipulations of the potter's fingers, sometimes assisted by some simple tool of wood or bone.

The first step in shaping a jug is by inserting one or two fingers of one hand into the center of the revolving lump, while the other hand is used to press on the outside. This produces a hole in the clay, which may be as wide as necessary, by simply moving the fingers to one side of the center. The clay now assumes the shape of a thick ring and is made thinner and drawn upward to form the side walls of the jug, by simply raising both hands at the same time, pulling the clay up between them. At this stage the article has assumed the form of a cylinder or wide-mouth jar, which a few touches at the brim will complete. To make the cylinder into a regulation jug, the upper rim is forced or bent inward with the hands, into the form of a dome, while the neck and lip are shaped with one finger inside the orifice and a stick on the outside.

The revolving mass of soft material responds readily to every touch of the fingers, bending this way or that, but the speed of the wheel must be comparatively slow; otherwise the centrifugal force would throw the walls outward and spoil the shape. If the jug is to have a handle, it is molded separately with the hands, bent into shape and the ends pressed into good contact with the moist jug. At the bottom, the jug is still stuck fast to the center of the wheel, but may be lifted off after drawing a fine wire under it.

After being properly dried, our farmer-potter proceeds to bake his pottery inside a long arch of brickwork. This arch has a chimney at one end and the fuel, which is wood, is fed into the other. In the arch, or oven, at intervals, there are loose bricks which may be removed during the firing, and common salt is thrown through these openings to produce a glaze on the surface of the ware. Some skill or experience is necessary to conduct the firing properly, or the pottery will be spoiled.

Though often ungraceful in shape, this pottery is still in common use wherever the distance from trade centers makes freight rates too dear on such bulky and heavy articles.



PORTABLE LIGHTS FOR CONSTRUCTION AND REPAIR WORK.

House Cleaning for Fishes.

In cleaning the tanks at the Aquarium they go about the work always in just the same order. In most cases the fishes come to be familiar with the process and govern themselves accordingly.

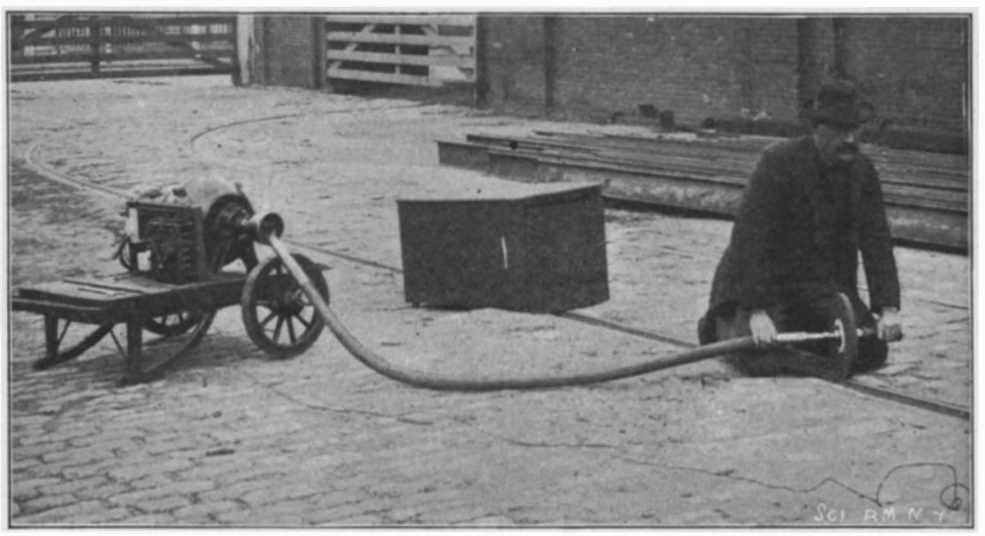
According to the New York Sun, the water in the tank is lowered to about half its usual depth, and the ends and the back and the glass of the tank are cleaned and scrubbed. The cleaning might easily be made very confusing, disturbing and dangerous to the fishes, for fishes are very easily frightened and likely then to do themselves injury, if not to kill themselves; but any such occurrence is avoided by going at the work on a system to which the fishes speedily accommodate themselves.

The cleaner always begins work on one end of a tank and always at the same end. The fishes appear to know perfectly what is going on, for when the cleaner begins there they always go to the other end of the tank and stay there quietly until the first end is cleaned, when they shift over to that end, staying there while the cleaner is at work elsewhere in the tank.

Next the man at the work tackles the back of the tank, the fishes then loafing around the front by the glass, and when the man gets through with the back and tackles the inside of the glass front of the tank, the fishes take possession of the back of the tank. The cleaner takes pains always, of course, to keep the long-handled brush with which he works close to the end or side upon which he is engaged; he doesn't slash around with it over into the part of the tank where the fishes have temporarily congregated, but is careful to let them realize that where they are, they're all right, and that nothing is going to interfere with them.

In many of the tanks, so well, apparently, do they understand it, that the fishes are scarcely disturbed by this systematic cleaning work at all; whereas with the work done in a helter-skelter way, even seasoned fishes would be thrown into a state of dangerous excitement.

In the valley of Camonica, in northern Italy, electric furnaces have been erected for the purpose of manufacturing pig iron under the Stassano patent. There are three furnaces, taking 500 horse power each, in each of which furnaces electrodes are employed, placed in the lower part. The ore is pulverized before being put in the furnaces, and a sample carefully inspected and analyzed with the object of ascertaining how much carbon will be necessary to reduce it successfully, likewise the required quantity of fluxes. After a determination of the lime, carbon and silicate, the proper proportions are added to the pulverized ore, and briquettes are formed, to which are added from 5 per cent to 10 per cent of coal tar. The furnace heat developed around the electric arc decomposes the iron ore, the oxygen with the carbon uniting to form carbon-dioxide. The figures given show that 3,000 horse power hours of the current, costing $3.42, are required to make one metric ton of iron.



PORTABLE MOTOR AND EMERY WHEEL FOR SMOOTHING WELDED JOINTS.

Automobile News.

Apart from the desirability of obviating the danger which attends the use of the highly volatile petroleum spirit in oil engines for motor-car purposes, the question of the difference in cost of the heavy oils and the spirit is of quite sufficient importance to encourage inventors to persevere in the direction of producing an engine which can utilize ordinary lamp oils without causing a nuisance and without becoming clogged up by oleaginous deposits resulting from combustion. According to the Engineer, still another method is working at the Sheffield Technical College and elsewhere with good results. In this case a new type of carbureter—the Moorwood-Bennet—is used, in which the oil, and not the air, is heated, and the air is caused to percolate through the former. In this instance a residue remains in the carbureter, but is not allowed to enter the motor cylinder; thus the exhaust is free from vapor and odor. The residue can be discharged at intervals.

Automobile goggles are a hideous necessity, and are particularly obnoxious to women automobilists. In order to provide an effective guard for the eyes which will be somewhat more sightly than the usual contrivance, various expedients have been resorted to. Paper fans, or screen-like masks, with designs of neatly-drawn heads, have been proposed by one ingenious artist. But the specimens which he produced, although greatly admired, were too artistically impractical for the purpose of the chauffeuse. Ladies found that the faces (portraits of Bernhardt, Rejane, Yvette Guilbert and other celebrities) were wonderfully attractive, but that they were by no means an adequate protection when the pace was fast and the dust flew up. Still another artist conceived the idea of using beaten silver masks representing the countenances of Greek goddesses. Although the faces of Artemis and Pallas were just as pleasing to look upon as those of French actresses, their weight was found to be unbearable. A milliner now comes along with a "creation" which springs, not from any artistic idea, but from a true appreciation of what is needed. He —for it is a man—has invented a mica veil perfectly transparent and yet absolutely dust and air proof. The veil is tied over the hat like the ordinary gauze fabric, and lends itself to manipulation just as readily. That the veil should sparkle and shimmer fantastically in the sunlight is by no means an objection.

M. Camille Jenatzy, a French automobile engineer, has devised a combination electric and petrol motor on the same vehicle. The system is economical and ingenious in its design. The apparatus comprises an internal combustion petrol engine, of which the flywheel on the crankshaft is replaced by a dynamo which acts as a flywheel at the same time as it sends current into a storage battery. The advantage claimed is that the petrol motor need only be of just sufficient power to propel the vehicle on the level at the highest desired speed, and that the energy stored in the battery can be utilized in the second (electric) motor when additional power is required. By this arrangement the petrol consumption is reduced by about 50 per cent. The car can be started by the electric motor, provided that a store of energy is present, and when the car is started the petrol engine can be thrown into gear. M. Camille Jenatzy, on a racing vehicle fitted with this electric-petrol combination motor, has covered a kilometer at the rate of 65 miles an hour, and has also made satisfactory trial with a public service omnibus weighing about five tons. Messrs. Lohner & Co., of Vienna, are also building automobiles propelled with electric-petrol motors, but which are entirely different in design from the Jenatzy apparatus. In the Lohner system an ordinary Daimler petrol engine drives a dynamo, which in turn operates electric motors on the hubs of the two front wheels. It is claimed that this arrangement gives a higher efficiency than the usual transmission through a change-speed gear. When full power is not wanted for immediate use, there is an arrangement by which part or all of the power of the engine may be diverted to storing energy in accumulators.

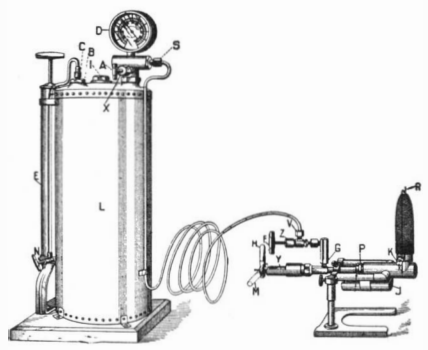
An exhibition is soon to be made on the Boulevard of this city of a new style of motor vehicle by Mr. C. L. Dorticus, lately perfected by him, which it is thought will be of special interest to automobilists, since it is an electric vehicle, without batteries, said to have a running limit of 150 miles without stop, and capable of being speeded anywhere from 5 to 30 miles an hour. This is at least three times the distance that any of the autocars now on the market are supposed to travel without having to stop to recharge batteries or replenish fuel. The inventor states that the operator of his machine can, after a delay of about ten minutes and the expenditure of a few cents at the most obscure country town, be ready to proceed another 150 miles. The new auto, it is stated, resembles a light runabout wagon in appearance, weighing altogether less than 800 pounds. There are said to be no gear wheels or chains visible or concealed in the whole make-up, and the running is noiseless and easy, the vehicle being under the perfect control of the operator at all times.

A NEW STEREOPTICON LIGHT.

The apparatus herewith illustrated is an improved form of a hydrocarbon burner in combination with a glow mantle of the Welsbach order, for the production, by the use of ordinary kerosene oil, of a brilliant white light particularly adapted for lantern illumination, as well as forming an artificial actinic light for photographic purposes. We are advised that it has lately been introduced by Williams, Brown & Earle, of Philadelphia, Pa.

The essential feature consists in vaporizing minute quantities of kerosene oil in a heated state under air pressure, which in mixing with air burns in the form of a gas and renders a mantle over the burner highly incandescent. The complete apparatus is quite light, easily set up and is readily put into operation.

The small air cylinder, *L*, carries at the bottom on the interior the kerosene oil (which should be of the best quality) under an air pressure of fifty pounds to the square inch, maintained when necessary by an attached bicycle pump, *E*. A small pressure gage, *D*, at the top registers the pressure. The oil is forced up by the air pressure through a tube extending in the interior to the bottom of the cylinder through a regulating valve, *X*, on the exterior and a very small spring coiled wire pipe to the burner, and the supply there is regulated by another valve, *F*. From this valve the oil passes through a hot tube at *P*, and is admitted by a needle opening further along in the form of a vapor to the concentric Bunsen burner located just to the front of *P* (not shown), which consuming part



IMPROVED LANTERN HYDROCARBON-BURNER.

of the vapor constantly keeps the tube hot; the rest continues to the main burner located under the mantle, *R*, at *K*, and burning the gas there renders the mantle incandescent. *Y* is the needler for the purpose of keeping the needle aperture clear.

To start the burner it is necessary to heat for a few minutes the vaporizing tube, *P*, which is done by igniting a small quantity of alcohol placed in the supplemental cistern, *J*, suspended underneath the vaporizing tube. Small inlet air tubes are arranged on each side of the inlet burner tube.

It will thus be seen that it is a very economical light to maintain.

Some English Bicycle Novelties.

The English Humber Company has brought out a novelty in the way of frame construction which it is hoped will attract buyers during the coming summer. It is a cross frame with double members in lieu of the lower main tube. This pattern is also shown with a spring attachment, the steering post working up and down inside a coil which is said to take up any vibration in the handle bars.

The Enfield Cycle Company has adopted a frame in which the ordinary diamond is stiffened by the use of extra tubes, one of which connects the bridge of the chain stays with the saddle pillar tube, while the other passes to the lower part of the head.

Searching for Baldwin.

A searching party is to be sent out to hunt up the Baldwin-Zeigler expedition. The steamer "Frithjof," which conveyed the Baldwin party to Franz Josef Land, has been chartered for the purpose. She will leave Tromsoe on July 1, under the command of Capt. Kjeldson, her former captain. From Tromsoe the "Frithjof" will go to Camp Zeigler, on Alger Island, 80 degrees 24 minutes north latitude. At this camp Baldwin's last instructions will be secured, after which the auxiliary expedition will proceed northward.

News of widespread desolation comes from Guatemala; all the towns, villages and plantations of the rich section of the country have been destroyed by earthquake. The loss of life is said to have been slight, owing to the easy means of escape offered by the low houses. The earthquakes are due to the activity of the Chingo volcano. Great damage was wrought in Solola, Santa Lucia, Nahuala and San Juan.

Electrical Notes.

At Stangfjorden, in Norway, a factory for the treatment of turf by electrical methods has been erected, and 400 kilowatts energy are now utilized in this manufacture. The process is patented by T. Jebsen, and is dependent upon the use of the electric current for heating purposes, in specially designed retorts. The turf is first dried, and formed into blocks by pressure, the water contents in this way being reduced to 20 per cent. The dried blocks are then inclosed in the retorts, and heated to the requisite temperature by the internally placed resistance coils. A gas useful for heating and illuminating purposes is obtained, while a tarry liquid also distills over, which can be worked up for paraffine, ammonium sulphate, and methyl alcohol. The turf charcoal remaining in the retorts is a useful substitute for either wood charcoal or gas-coke. The electrical installation at Stangfjorden comprises five 128 horse power turbines, direct-coupled to five dynamos of equivalent size and capacity. The current from these is used for heating the retorts, while a separate turbine supplies the requisite mechanical power. The 12 retorts are designed to deal with 1,000 centners of air-dried turf per day.

A curious parallelism is presented between the well-known Hoepfner process for the extraction of copper from its ores and compounds, and a method just patented by Paul Bergsoe of Copenhagen for the electrolytic recovery of tin from scrap and waste alloys. The Hoepfner process, it will be recalled, depends upon the varying valence of copper, and consists in bringing a salt of copper in its higher state of oxidation into contact with the ore, whereupon copper passes into solution and the solvent is reduced from the cupric to the cuprous condition; this solution is then electrolyzed with insoluble anodes to deposit one-half of its metal, restoring the remainder to its original valence and reconstituting the solvent. Bergsoe reacts upon tin-bearing materials with stannic chloride, and subjects the stannous salt formed to electrolytic treatment as above, restoring its valence and solvent power, and recovering an amount of metal equivalent to that dissolved. Both methods are simple, and indeed identical in theory. The Hoepfner process has encountered in practice the very serious obstacle of a low reaction velocity—a solvent action so slow as to render its application to the most commonly occurring ores of copper, the sulphides, of doubtful practicability. From this defect the new process is free, for the stannic salts are energetic solvents. The successful treatment of tin scrap, however, has proven in the past a difficult problem, not only on account of its very low tin content, but because of the tendency of the iron to pass with the tin into solution. As applied to this purpose, therefore, the value of the new process is to be demonstrated.—Electrical World.

The conversion of the Mersey Tunnel Railroad to electric traction, by the British Westinghouse Electric and Manufacturing Company, Limited, is rapidly approaching completion. This railroad, upon which at present steam traction is utilized, has never been a paying concern and has passed through many vicissitudes. Yet the traffic over the railroad is sufficiently heavy to render it remunerative, and it is anticipated that by the utilization of the more economical electric system of haulage this end will be attained. The present steam traction, which necessitates the provision of an elaborate system of ventilation, is so abnormally expensive that there is no possibility of any profit being made. The Westinghouse Company, convinced that the railroad would pay if electricity were adopted, approached the directors of the company and offered to effect the necessary conversion at a cost of approximately $3,175,000. The railroad is being reconstructed upon the third-rail system, the current rail being laid in the center of the existing track. The Board of Trade, however, have insisted that the track rails shall not be utilized for the return current, as is generally the case, so a fourth rail is being laid outside the track. The necessary conversion is being carried out without interfering with the traffic, the third and fourth rails being laid at night, during the suspension of traffic. The current is being conveyed from the generating station to the tunnel by means of huge cables. The rolling stock is to be similar to that at present in use upon the Central London Electric Railroad. A large generating station is being erected at the Birkenhead terminus of the line. It is an imposing building of brick with stone facings, and is 145 feet in length by 135 feet in breadth and 74 feet high. It is divided into two departments, the generating and boiler houses, respectively. The station is now ready for the reception of the generating plant and machinery, which are being manufactured at the Pittsburg works of the Westinghouse Company of this country. There will be three generators of 600 kilowatts each, and two of 200 kilowatts each, capacity, the necessary steam power being supplied from nine Stirling boilers. The trains will be run with a voltage of 550, the same as that by which the electric cars in Liverpool Street are propelled.

TAMENESS OF WILD ANIMALS.

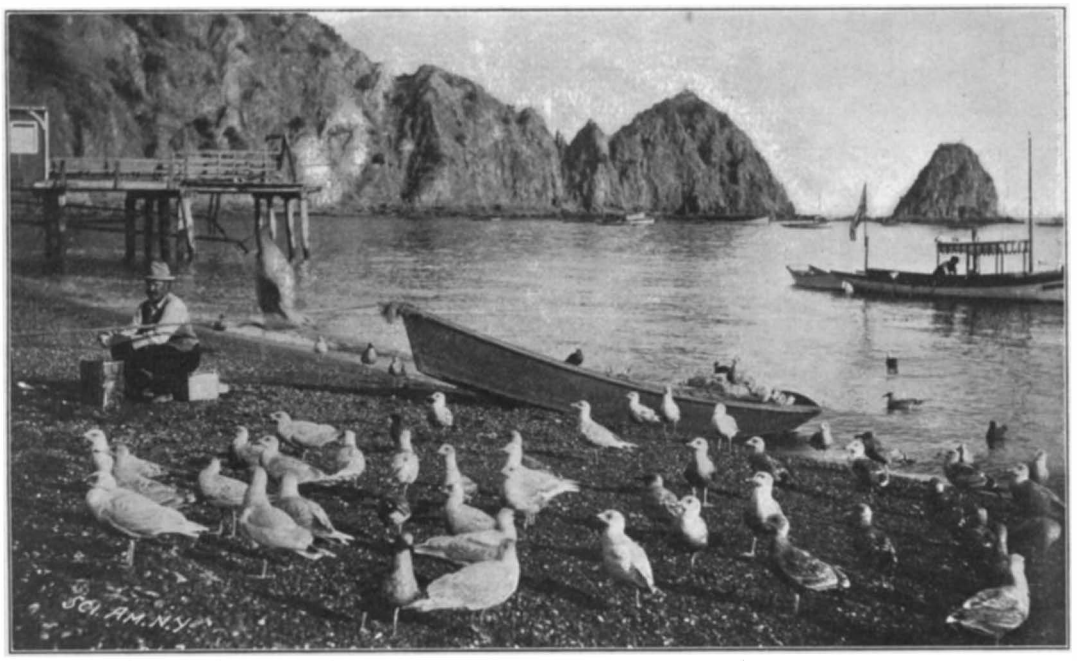
BY CHARLES F. HOLDER.

When the white man first visited some of the islands of the Southern Hemisphere, he found that many animals, especially the birds, were absolutely fearless. Penguins, albatrosses and others paid no attention to the men as they walked along, and when it was desired to photograph a nest and eggs it was frequently necessary to push the nesting albatross from the nest, the bird merely pecking at the intruder. Darwin describes doves at one island he visited as apparently unable to comprehend that man was an enemy. The birds could be shoved from the limbs before they moved, and even attempted to alight upon the heads of the men. In Kerguelen Land the birds in some of the extensive rookeries refused to move as the men strode along, holding their ground and pecking so violently at the invaders that they were forced to beat a retreat. These birds had never seen a man before, and failed to recognize him as an enemy.

The great auk, that was formerly a fairly common bird on the northeast American coast, had so much confidence in the human animal that it could be knocked down with a club, and even picked up. Some years ago I visited a key on the outer Florida reef where a tern was nesting, and found the birds remarkably tame, though not to the extent that they allowed themselves to be picked up, this being true in the case of several gallinules. The terns were in such numbers on Bird Key that they formed a black cloud over it, at times distinctly visible two miles distant. When I landed the noise was so loud and incessant that the human voice could scarcely be heard, even if words were shouted. It was Babel worse confounded—the incessant clamor of thousands of birds; yet I found that absolute silence could be produced for a few seconds merely by shouting at the top of my voice, whereupon every bird apparently stopped crying to listen; then the furious clamor would be continued. These birds were so tame that they flew so near my head that I could almost touch them, and the noddies on the nest sometimes refused to move, and even allowed me to stroke them.

An interesting instance of the tameness of birds is illustrated in the accompanying photograph, which represents a daily scene on the shores of Avalon Bay, Santa Catalina Island, California. Flocks of gulls follow the steamers to and from the mainland daily, a distance of twenty-two miles, resting on the gold ball at the masthead when weary. At Avalon a large contingent lives the year around except during the breeding season, when they depart to some less frequented shore. The birds are extremely tame, and it is one of the pastimes of tourists and visitors to feed the gulls which flock about them fighting for the food. In the log of one of the early expeditions up the Californian coast Father Torquemada mentions the tameness of the ravens of Catalina. There was a cause for this; the birds were looked upon with a certain amount of reverence by the natives, who never killed them; hence the cunning creatures took advantage of it, and literally snatched fish from the hands of the women as they cleaned them on the sands. Whether the ancestors of the gulls of Avalon to-day were included among these tame birds, and the latter have inherited some of their fearlessness, is not known, but the fact remains that they are remarkably tame, and some old birds permit Vincente, one of the fishermen, to pick them up. The photograph shows the birds waiting for the rejectamenta of the fishing haul. The fishes are cleaned on the beach, and every portion carried away by the birds, which constitute a sanitary corps of remarkable excellence. Nothing escapes their sharp eyes, and the beaches of the island are kept clean by these flocks of gulls.

The sea lions, which have a rookery here, are also tame and equally valuable. They allow boats to approach within a few feet of them at the rookery, and pose for their photographs with perfect abandon. In the afternoon, after the fishermen return, they come into the bay and carry off the fish that have sunk to the bottom out of the reach of the gulls. Some of the sea lions are so persistent that I have had one of this herd follow my boat and take the bait when six or eight feet from the boat, so deftly that it was not hooked. A seal would poise upright in the water and dash at the bait as soon as it was tossed overboard. One of the sea lions finally became so tame that it would snatch fish from the hands of a fisherman who was washing them. This perhaps is due to the fact that the animals are protected; no one is allowed to shoot or molest them in any way.



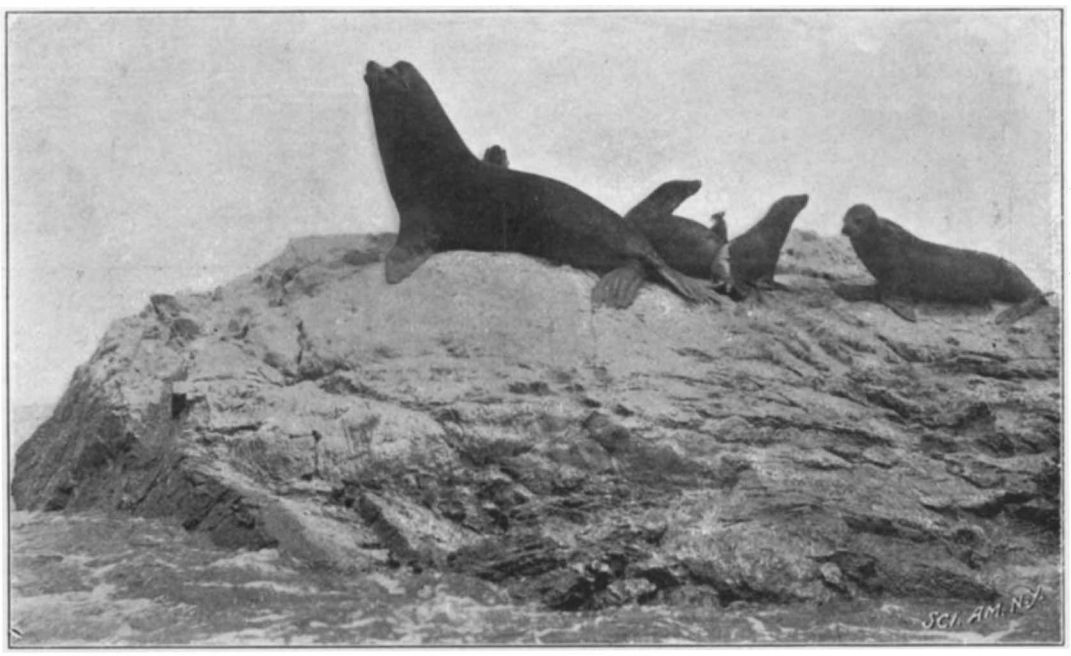
THE TAME GULLS OF AVALON, CALIFORNIA.

The lack of timidity on the part of the buffalo was one cause of the ease with which it was exterminated, the animals often standing while man approached, only moving off when it was too late. Many elk lose their lives from over-confidence in human beings.

In Florida I found that in certain places—out-of-the-way keys where men were rarely seen—the crabs were remarkably tame. Thus on Garden and Long keys the spirit crab was extremely timid, the islands being visited every day; but on North, East or Middle keys, where the crabs probably never had seen a human being, instead of running they would stand, and when I lay down upon the sands it was not long before numbers were crawling about me, evidently actuated by curiosity.

The whale is generally considered to be a very timid animal, but there are many instances where these huge creatures have apparently been without fear. A veracious fisherman of the New England coast informed me that he had more than once been annoyed by whales, the animal insisting upon following the dory, rubbing against it and lifting it out of water, and undoubtedly would have tipped it over had not the plucky fisherman thrust an old scythe blade, which it happened he had, into its blubber, thus driving it off. The utter absence of fear among whales has often been exemplified on the Pacific coast. A large whale on one occasion joined a ship a few miles out from San Francisco and followed her nearly to South America. Everything that could be done to drive it off was tried, without avail; the whale refused to part company, and was only driven away when the vessel put into a shallow harbor. A pilotboat was once followed by several large whales. A yachting party known to the writer became becalmed in Southern Californian waters, and four or five large whales played about the vessel for hours, so near that the spray from the "spouting" was extremely offensive, while the trembling motion, the heavings and liftings as the monsters scraped the keel, added not a little to the discomfort, not to say nervousness, of the voyagers.

In rare instances fishes appear to be without fear. This was particularly noticeable in the case of several trunk fishes which I found on the Florida reef in an old dead coral head of large size. At low tide I could reach from my boat nearly to the bottom of the head by bending over, and in attempting to dislodge some gorgonias which were clinging to the coral I was surprised to see several of the little armored fishes swim up to my hand and permit me to touch them—an act which I often repeated. The mullet is very tame. I have frequently stood knee-deep on the outer reef and had large schools all about me within eight or ten feet, and even when I moved along they were not alarmed. This sociability explains the possibility of taking them with the cast net.



TAME SEA LIONS AT SANTA CATALINA.

Ancient Babylon.

The members of the Babylonian expedition sent out by the German Oriental Society have, in spite of the heat, wind and dust, held out steadfastly at their post, and have brought to light many valuable memorials which, with those already unearthed, will some day give a faithful picture of the ancient metropolis, its streets, temples and palaces and its social, intellectual and religious life. Up to now four hundred inscribed clay slabs have been found in the center of the ruins of Babylon. Of only two of them are the inscriptions yet deciphered, but they are pearls of Babylonian literature. One tablet contains a great part of a celebrated Babylonian compendium which explains the Babylonian cuneiform characters. It is a very ancient dictionary, of great linguistic interest, and of exceptional value practically. The second tablet contains no less than the litany which was chanted by the singers of the Temple of Esagila on the return of the god Marduk to his sanctuary. Marduk, or Merodach, was the son of Ea, and one of the twelve great gods of the Assyro-Babylonian Pantheon. His temple, Esagila, "the exalted house," became the national sanctuary of the whole empire. He also had a sanctuary at Sippar. He is twice mentioned in the Book of Jeremiah, and in Isaiah, as Bel. It was the custom to sing the litany which has now been found after the periodical procession to that grand pantheon which has been brought to light by the expedition, and which, it is hoped, by the winter will be completely excavated.

In the meantime Herren Koldewey and Andrae have made another important discovery, a temple of Ador, or Nineb, the tutelar god of physicians, hitherto quite unknown.

The German Oriental Society's account of these discoveries, which has just been published, also gives a minute description of an amulet, supposed to protect the wearer from the machinations of the demon Labartu. Labartu was an ashen hued being who made people pale with terror, drank human blood, caused great sorrow, and was accompanied by a black dog. This amulet was once hung round a child's neck in order to drive off the demon.

It has been decided by the directors of the Hamburg-American Line to increase the capital of the company by $4,000,000, in order to pay for steamers at present under construction. Of these steamers ten have a collective tonnage of 77,730. When completed the vessels will increase the number of Hamburg-American liners to 127, and the total tonnage to 630,091.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SHOVEL-PLOW.—J. Michalka, Cameron, Texas. This invention relates to certain improvements in shovel-plows by means of which the stock and shoe may be securely mounted and yet adjusted from one position to another according to the work to be performed.

PLANTER.—J. A. Anderson, Munson, Ill. The seed-dropping device of the planter is so constructed that it may be reversed or set as many times as it is necessary in the field to plant from one to four kernels of corn in a hill without requiring the operator to dismount from the machine. The device is designed to cause no wear or strain upon the check-row wire, and will plant in a straight line crosswise of the field, as the check-row only operates the plunger in the shoe.

Apparatus for Special Purposes.

MEANS FOR COMPRESSING OR LIQUEFYING GASES.—B. Borland, Cambridge, Mass. This invention provides means for compressing and liquefying gases—such, for instance, as ammonia and carbon dioxide—for the purpose of obtaining such gases in their liquid form for any desired use. The apparatus is so constructed that it may be easily controlled and successfully used in large bodies of water—as, for example, the ocean.

Electrical Apparatus.

LAMP-HANGER.—H. J. Harrison, Juneau, Alaska Ty. This invention relates to a device for hanging electric lamps so that the lamps may be raised or lowered to any height desired. This end is attained by a certain arrangement of parts involving a roller or drum carrying a conductor and actuated in one direction by a spring, so as normally to wind the conductor on the drum, the drum being actuated manually in a contrary direction and being arranged with the dog which will hold it in any position desired.

ELECTRIC FLY-TRAP.—E. R. Greene, Providence, R. I. This improved electric fly-killer is especially designed for use in stores, kitchens, dining-rooms and other places. The insects are lured to the apparatus by suitable bait, whereupon an electric current is passed through their bodies to instantly electrocute them.

PARTY-LINE TELEPHONE APPARATUS.—G. Möller, Nordre Frihavnsveg, 50A, Copenhagen, Denmark. This apparatus provides a simple arrangement whereby several subscribers are enabled to employ a single line to the central office, and whereby such subscribers may be connected either with other subscribers on the same line or with such subscribers whose lines lead to the same central office. The present arrangement differs from similar apparatus heretofore devised in so far as every subscriber is enabled to communicate directly with the central office and in so far as the ordinary sub-station battery of every subscriber is used for the purpose of cutting out all other lines.

Engineering Improvements.

PUMP-OPERATING MECHANISM.—J. B. Miller, Muncie, Ind. This invention provides a pump for air or water, in which a series of pistons are successively depressed by wheels or rollers traveling in a circle over them. The inventor informs us that the machine has been built, and operates eight pumps 9 inches in diameter and with 12-inch stroke. Four wheels are used, giving 250 strokes per minute, while the central shaft makes 8 revolutions per minute. This is done at an expenditure of 5 horsepower.

Miscellaneous Inventions.

NON-REFILLABLE BOTTLE.—F. Klein, New York, N. Y. The purpose of the invention is to provide a novel construction of cap or outlet section for the bottle, whereby, after the bottle has been emptied of its contents, it cannot be refilled and again presented as an original package. The neck is formed in a series of connected members at angles to each other, the mouth or outlet member extending across the face of one of the intermediate members, approximating in shape that of a figure 4.

NON-REFILLABLE BOTTLE.—J. Y. Payton, Waldron, Ark. A novel construction is provided by which the contents of the bottle may be dispensed as desired, but which will prevent refilling. The bottle has its neck provided with a bottom wall having a filling-port, and is provided alongside the neck with a tubular portion communicating at its lower end with the neck and affording an outlet or discharge port. A rotatable dispensing device is situated in the neck above the bottom wall and has a slot or opening which may be adjusted to successively register with the inlet and outlet ports.

HAIR-FASTENER.—A. G. Smith, Cheyenne, Wyo. The hairpin is provided with means for fastening it securely in the hair, thus preventing the loss of the pin. A bolt in the curved head of the hairpin is adapted to pass through the hair at the upper end of the prongs, thereby securing the hair-fastener in position.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 2513.—For parties to manufacture rubber rings.

Motor Vehicles. Duryea Power Co., Reading, Pa.

Inquiry No. 2514.—For manufacturers of spring motors.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2515.—For parties to make a 6 h. p. compressed air engine.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 2516.—For makers of worm well augers which bore by hand or machinery.

Manufacturers' agent; accounts wanted. S. Duncan, Dallas, Texas.

Inquiry No. 2517.—For makers of razor and spectacle cases.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 2518.—For the makers of a machine for twisting wire around paper twine.

Sheet metal, any kind, cut, formed, any shape. Prompt work. Metal Stamping Co. Niagara Falls, N. Y.

Inquiry No. 2519.—For the makers of the Chalefow's condensed milk can opener.

Are you looking for anything in bent woodwork? Write Tucker Bicycle Woodwork Co., Urbana, Ohio.

Inquiry No. 2520.—For makers of small acetylene lamps.

For inventors and patentees soft, smooth iron castings. Address Atlantic Foundry, Phillipsburg, N. J.

Inquiry No. 2521.—For dealers in pointed steel wire ¼ inch diameter and 6 inches long.

Gear Cutting of every description accurately done. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 2522.—For makers of small draw fans.

For Sale.—U. S. 1902 latest beautiful patent on bicycle. For particulars address Tarzian Brothers, Paterson. N. J.

Inquiry No. 2523.—For makers of pure copper hard rolled, one foot wide.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2524.—For an oil burner for stationary boilers or furnaces.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2525.—For the address of the Avery Thrashing Machine Manufacturing Company.

Patents developed and manufactured, dies, special tools, metal stamping and screw machine work. Metal Novelty Works Co., 43-47 S. Canal St., Chicago.

Inquiry No. 2526.—For makers of fruit-drying and oil-extracting machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2527.—For a small dynamo for experimental work.

Ideas Developed.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 2528.—For machinery for making all kinds of wire goods.

High-class machinist and toolmaker desires model or experimental work, or will invent anything for you. W. Gustafson, 226 Atlantic Ave., Brooklyn, New York.

Inquiry No. 2529.—For makers of ball-bearing castors.

Wanted.—A thorough, reliable and practical automobile man, one that understands the manufacture of automobiles in every detail. State age and experience "Red Cross," Box 773, New York.

Inquiry No. 2530.—For makers of pearl button-making machinery.

Manufacturers of slot machines, vending of every description, bar supplies and novelties. Send illustration with lowest cash price, f. o. b. New York. Large quantities. J. Landes, 108 Pitt Str., Sydney, Australia.

Inquiry No. 2531.—For a mechanical device for generating power by a weight, like that of a clock.

Any one interested in locating advantageous manufacturing plants address L. C. Root, Stamford, Conn.

Inquiry No. 2532.—For makers of the hydraulic jack U. S. patent No 201,114 of March 12, 1878. One with the pump and release within the base.

Inquiry No. 2533.—For makers of the small "snap fasteners" used on gloves etc.

Inquiry No. 2534.—For dealers in the threads and machinery for making shoe laces.

Inquiry No. 2535.—For makers of paper boxes.

Inquiry No. 2536.—For parties to make a shield of hard pasteboard 10 x 16 inches in size.

Inquiry No. 2537.—For parties to make a pasteboard puzzle of intricate design 4 inches long by 4 x 1.

Inquiry No. 2538.—For dealers in metal specialties, novelties and articles of merit.

Inquiry No. 2539.—For makers of sash bars for greenhouses.

Inquiry No. 2540.—For parties to engrave or etch on glass compass dials of special dimensions.

Inquiry No. 2541.—For makers of turn stiles which register the number of people passing through them.

Inquiry No. 2542.—For dealers in invisible ink.

Inquiry No. 2543.—For a dynamo for running electric fans.

Inquiry No. 2544.—For machinery for making wax matches.

Inquiry No. 2545.—For parties to build a motor bicycle for experimental work.

Inquiry No. 2546.—For machines for making paper and wood pulp.

Inquiry No. 2547.—For the address of the Marilla Incubator Company.

Inquiry No. 2548.—For twine-making machinery.

Inquiry No. 2549.—For a machine for affixing stamps on letters and circulars.

Inquiry No. 2550.—For a spring motor for running shelves inside a showcase.

Inquiry No. 2551.—For a kerosene oil burner to generate 400 deg. of heat within four hours from time of lighting.

Inquiry No. 2552.—For machinery for making oval wooden butter dishes.

Inquiry No. 2553.—For makers of clothespin-making machinery.

Inquiry No. 2554.—For manufacturers of cast iron water mains.

Inquiry No. 2555.—For manufacturers of pearl, rubber or composition buttons.

Inquiry No. 2556.—For the makers of a machine for separating mineral substances, acting upon the principle of the "Cyclone."

Inquiry No. 2557.—For dealers in milking machines.

Inquiry No. 2558.—For makers of small camphor distilleries.

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Fore River Ship and Engine Co. Quincy, Mass.

Treasurer's Office, 156 Federal Street, Boston, Mass.

INCORPORATED UNDER THE LAWS OF NEW JERSEY.

...DIRECTORS...

THOMAS A. WATSON, - - - - - - - - - - President.
D. H. ANDREWS, - - - - - - President Boston Bridge Works.
CHARLES S. DENNIS, President Dennis & Lovejoy Wharf and Warehouse Co.
JAMES B. DILL, Attorney-at-Law, Author of "Dill on New Jersey Corporations."
GEORGE W. DAVENPORT, - - - - - Secretary and Treasurer.
FRANK O. WELLINGTON, - - - - - - - General Manager.
HOWARD P. ELWELL, - - - - - General Superintendent.
WILLIAM C. HABBERLEY, - - - - - - - - - Auditor.

The Company offers for public subscription **10,000 Shares of Preferred Stock** on the following terms: Preferred Stock at $100 per share, and of the 10,000 shares of common stock now in treasury one share will be given as a **bonus** with every two shares of preferred.

In case of subscription for one share only of preferred stock at $100 per share, a share of common stock will be reserved for 90 days and issued as a bonus if a second share of preferred stock is subscribed for within that time.

The right is reserved to withdraw or reduce the bonus of common stock without notice.

The founders of the business have personally invested over one million dollars in cash in the stock of the Fore River Ship and Engine Co. before the present offering of stock to the public is made.

CAPITALIZATION.

Fore River Ship and Engine Co. is capitalized as follows:

Preferred Stock, - 20,000 Shares, - $2,000,000.
Common Stock, - 20,000 Shares, - $2,000,000.

Par Value of Shares, $100, full paid and non-assessable.

There Is No Bonded Indebtedness

The preferred stock has a non-cumulative first preference upon the net profits of the Company up to 7 per cent. per annum. In case of liquidation or dissolution of the Company, and distribution of its assets, the Charter provides that $125 per share must be paid to preferred stockholders before anything is paid to holders of the common stock.

The Charter further provides that one-half of all net profits in excess of 7 per cent. on the preferred stock shall be held as a sinking fund which on reaching $100,000 must be applied to redeeming the preferred stock at $125 per share, or at a lower price if so offered by holders to the Company, to such amount as such sum will redeem. For example: when there is $200,000 of net profits over and above the dividend on the preferred stock, $100,000 is applicable to a dividend on the common and $100,000 must be applied to redemption of a portion of the preferred stock.

Of the above $4,000,000 total stock authorized, there is now in the treasury of the Company $1,000,000 preferred and $1,000,000 common.

Prior to the incorporation of this Company in February, 1901, the business had been conducted for seventeen years by Messrs. T. A. Watson and F. O. Wellington as a co-partnership. During the last two years and since the incorporation of the Company, the sum of $1,500,000 cash has been expended on the plant.

There is at present outstanding $1,000,000 of preferred stock and $1,000,000 of common stock issued against a plant which has cost $1,500,000 cash; and the stock now to be sold provides cash for additions to plant and working capital to the amount of $1,000,000.

The provisions of the Charter guarding the investor in this preferred stock are exceedingly strong, being drawn with great care by the highest legal talent. It has a preference not only on the net profits up to 7 per cent., but also upon the assets of the Company in case of distribution.

EARNINGS.

The earnings of the Company for five months to January 1, 1902, were $101,574.36 in accordauce with the certificate of the Eastern Audit Company.

The entire $2,000,000 preferred stock requires but $140,000 for its 7 per cent. dividends. The Company earned, at the rate of over $100,000 in excess of the amount required to pay the dividend on the entire $2,000,000 preferred stock, this while construction of the works was under way.

By the operation of the sinking fund the earnings applicable to the common stock will naturally increase, and with the Company earning from $400,000 to $500,000 per annum in the future, which is quite possible with the yard filled with work, it will be seen that owing to the small capitalization the common stock is likely to earn very large dividends in the future.

By the provision that a sum equal to any dividends on the common stock must be used to retire preferred stock, it is probable that the preferred stock will rapidly decrease. As it decreases the common stock will command more of the net earnings of the Company on the small capitalization of $2,000,000.

DIVIDENDS.

By the terms of the Charter, semi-annual dividends on the preferred stock are payable on the second Mondays in January and July, out of the earnings of the Company.

In accordance with this provision a dividend on the preferred stock of 3½ per cent. will be paid on July 14th, 1902, out of accrued earnings.

Description of Property and Contracts

Below is a brief description of the Company's plant, and business and contracts in hand:

REAL ESTATE.

78 Acres of Land, Bounded by 1¾ Miles of Water Front

The buildings enumerated here are only the larger buildings comprising the Company's plant. In addition to these there is a large office building and some fifteen other buildings which it is unnecessary to mention in detail. Outside of the plant proper the Company owns a number of dwelling houses and other real estate in Quincy, which produces a substantial income, and this outside real estate is conservatively held as being worth $100,000.

BUILDINGS.

Forge	107x200	21,400 sq. ft.	Woodwork Shop and Mold Loft	(304x72) 2 floors	43,776 sq. ft.
Annealing Plant	(40x40) 2; 43x56	5,608 "	Ship Tool Shop	390x143 "	55,770 "
Carpenter Shop	(105x72) 2 floors	15,120 "	Machine Shop	400x118	
Store House	(165x72) 2 "	32,760 "	Gallery	(400x28)	
Pattern Storage	(105x72) 2 "	15,120 "	Basement	(288x23)	76,224 "
Power House	162x65	10,530 "	Ship House	490x325	159,250 "
Coal Pockets	65x48	3,120 "	Ship Carpenter Shop	50x50	2,500 "
		103,658 "			337,520 "

Total area under roof (nearly eleven acres) - 441,178 square feet.

The forge in the above list is one of the three large forging plants in this country and Fore River is the only shipyard having a forge capable of the largest work in ship-building. This forge is also kept busy on miscellaneous outside work.

Work in Progress in Fore River Yard

APRIL 1, 1902.

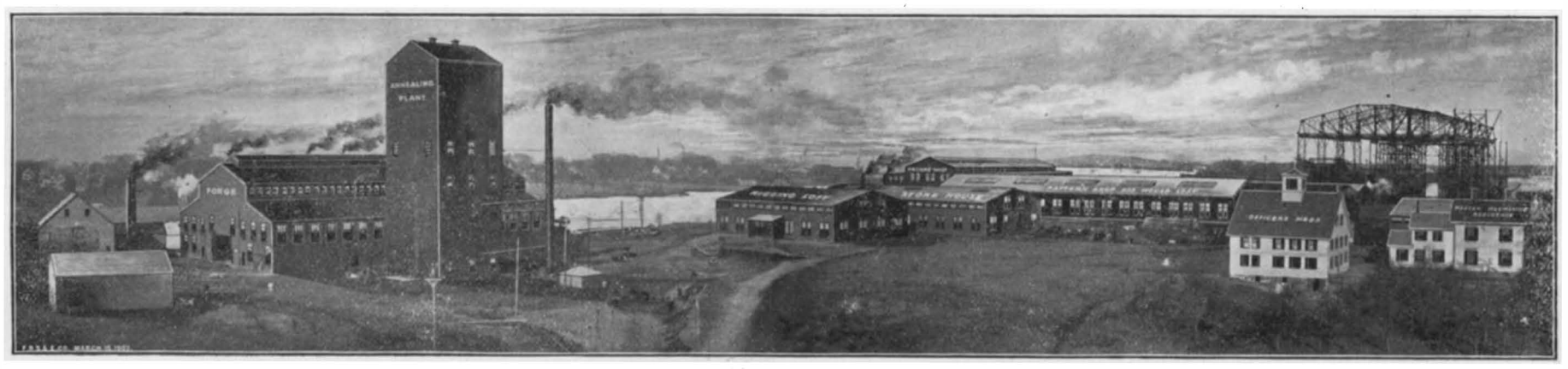
BATTLESHIP—NEW JERSEY. 15,000 tons.
BATTLESHIP—RHODE ISLAND. 15,000 tons.
CRUISER—DES MOINES.
TORPEDO BOAT DESTROYER—LAWRENCE.
TORPEDO BOAT DESTROYER—MACDONOUGH.
SEVEN MASTED STEEL SCHOONER (11,000 tons displacement).
(The largest sailing vessel in the world.)
FORGINGS for Steamships now being built in other yards.
STEEL BRIDGE, 800 feet long, over Weymouth, Fore River.
SEVENTY-FIVE SETS FORGINGS for rapid fire guns.
MISCELLANEOUS STRUCTURAL WORK.

The above, with other work in hand, will bring the total amount of contracts up to $8,907,000.

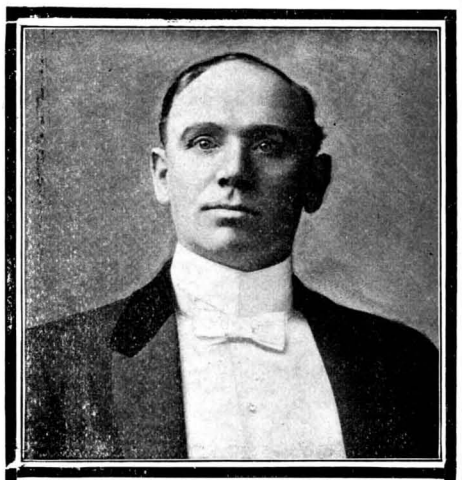
In addition to the above contracts in hand, the Company has tenders under consideration for additional work aggregating several million dollars.

Upon application to the Boston office of the Company, a copy of the Charter of the Company, and an illustrated description of the plant will be sent by mail. Commercial Agency and Bank references. Copies of reports made on the property by several eminent engineers and naval experts may be seen on application.

Subscriptions may be made by letter directed to the Fore River Ship and Engine Co., 156 Federal Street, Boston, Mass., or Federal Trust Co., Boston, Mass. Remittances may be made by check, registered letter or money order payable either to Fore River Ship and Engine Co., or Federal Trust Co. of Boston.



A GENERAL VIEW OF THE FORE RIVER WORKS.



Fitzsimmons Will Teach You to be Healthy and Strong

Perfect health casts out disease, and perfect health is a thing that I can give you.

Intelligent physical culture, such as I am teaching, will give you healthy circulation, steady nerves, firm muscles and a clear brain. I can make you healthy, quick, supple and muscular. My own unsurpassed physical condition is entirely due to my own system of training. What I have done for myself I can do for you.

I worked out the system myself, and have been practicing it and teaching it to others for years. However run down, ill or weak you may be, I can build you up. Mine is

The Best and Most Intelligent System of Physical Culture in the World

I can teach it to YOU by mail.

Follow my advice and I will make you stronger, healthier and happier than you ever thought you could be.

You will need no more medicine, for you will be as well as I am. I can cure your dyspepsia; I can prevent appendicitis, and I can preserve you from nervous prostration.

Mine is a scientific and **individual** method of instruction. I plan the exercises to fit **you,** gradually building you up to your proper condition. Afterwards I teach you how to keep yourself in perfect health.

Every pupil of mine has the benefit of my personal and individual attention. I write a separate personal letter to each pupil telling him just what to do and how to do it, after I have made a careful study of his case. Photographs and letters keep me constantly informed of my pupils' progress, so that I can tell just how they are getting along as well as if I had them at my side. All my hard-won experience is at my pupils' service. I am doing this thing myself.

No apparatus is used in my method. It is a system of exact and scientific physical culture for busy people who use their brains. It helps men and women to work and to think.

Write to me and I will send you a booklet telling you more particularly what I can do to make men and women physically perfect, as well as giving you information concerning terms. Address

The Robert Fitzsimmons Institute of Physical Culture

Bensonhurst. New York

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Heel, cushioned, J. H. Melavin	699,111
Heel holder for heel attaching machines, F. F. Raymond, 2d	699,113
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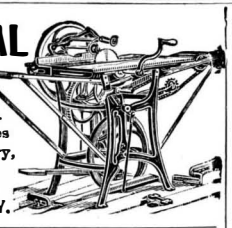

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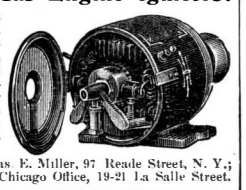

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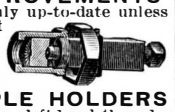

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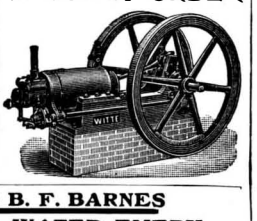

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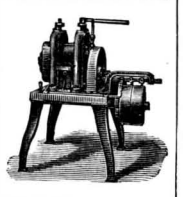

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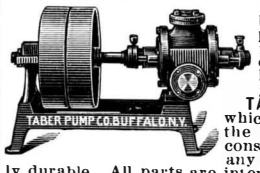

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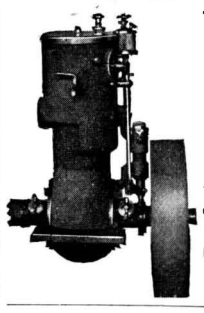

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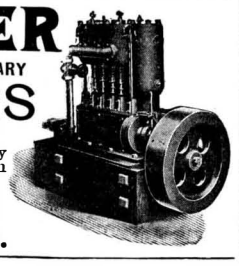

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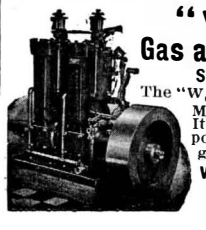

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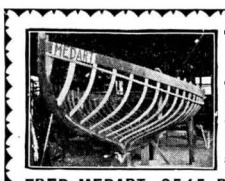

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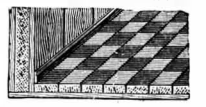

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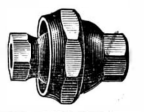

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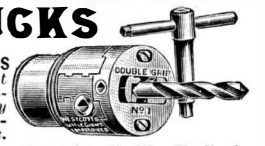

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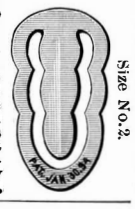

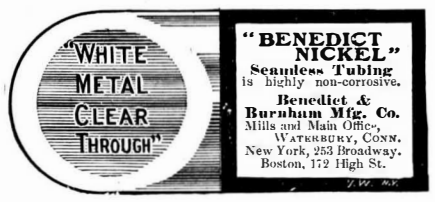

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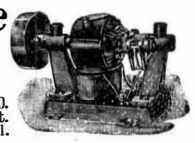

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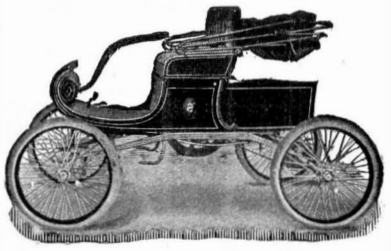

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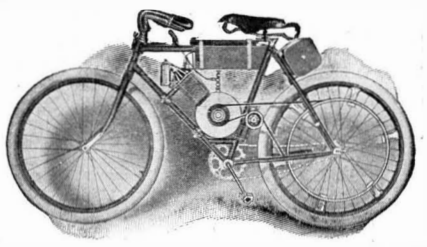

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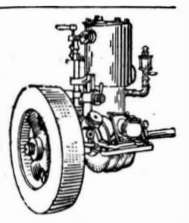

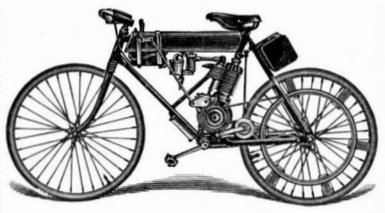

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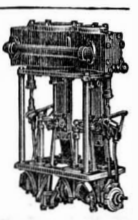

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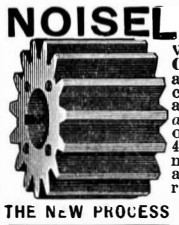

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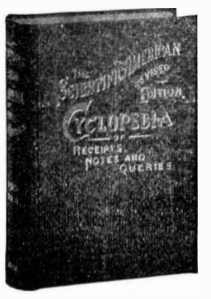

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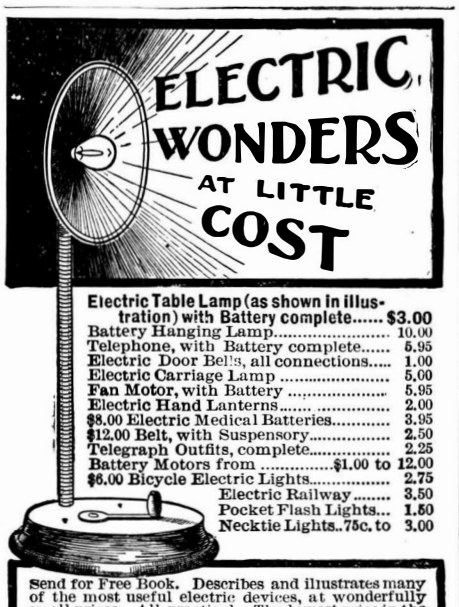

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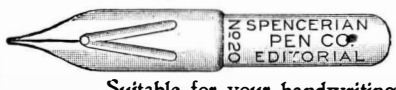

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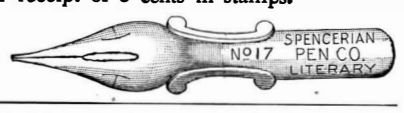

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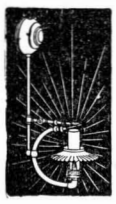

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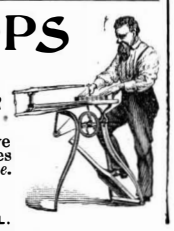

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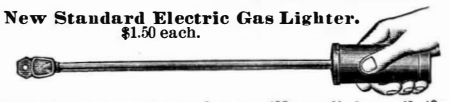

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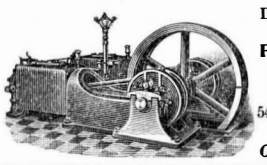

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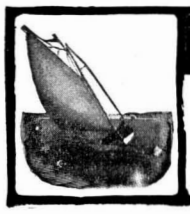

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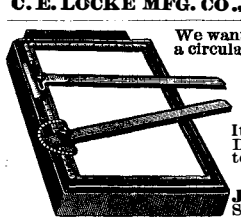

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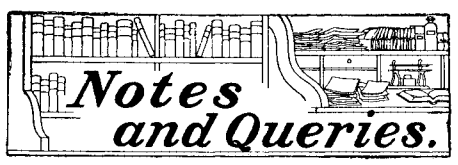

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(8600) G. M. D. asks: What should be the dimensions, size and amount of wire for a 12-inch coil, 15-inch coil and 18-inch coil? Is there any definite relation existing whereby the above information may be determined from a known coil? A. The dimensions of induction coils are the result of experience rather than of calculation. The properties of the magnetic circuit and the effects of induction are well known, and can be applied to an induction for giving sparks; but almost every builder works from designs which have been wrought out by experiment and are known to give good results. The sizes and windings of certain large coils are given in Hare's "Large Induction Coils," price $2.50 by mail.

(8601) A. B. writes: I am desirous of studying the science of electricity from the very beginning. Please suggest what would be best, and the price. A. We should advise that you buy Jackson's "Elementary Electricity," price $1.40 by mail, and Swoope's "Practical Electricity," price $2 by mail, with which to make a beginning of the study of electricity. After these are mastered there are many special works on separate subjects for study.

(8602) D. C. asks: Can you inform me what the solution is in which incandescent gas mantles are washed or dipped to render them incandescent? A. Oxides of the rare earths are used for coating the mantles of incandescent gas burners.

(8603) J. O. H. asks: In the building of motors or dynamos, is it a rule to use coarser wire on fields than armature, and why? A. The size of wire in field and armature is a matter of calculation, and may give either a coarser or finer wire on armature than on field.

(8604) P. S. S. asks: What solution is used in plating, for instance silver, or nickel, when batteries are used for circuit? A. For nickel the double sulphate of nickel and ammonium is commonly employed, and for silver the cyanide of silver is almost universally used. Full instructions are to be found in Langbein's "Electro-Deposition of Metals," price $4 by mail.

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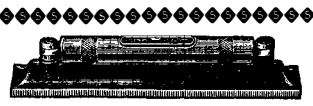

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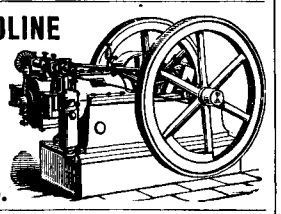

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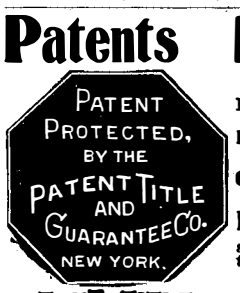

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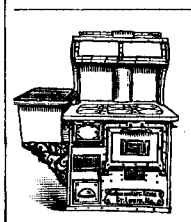

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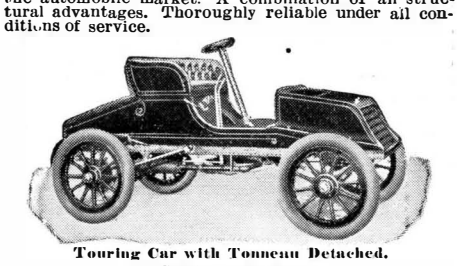

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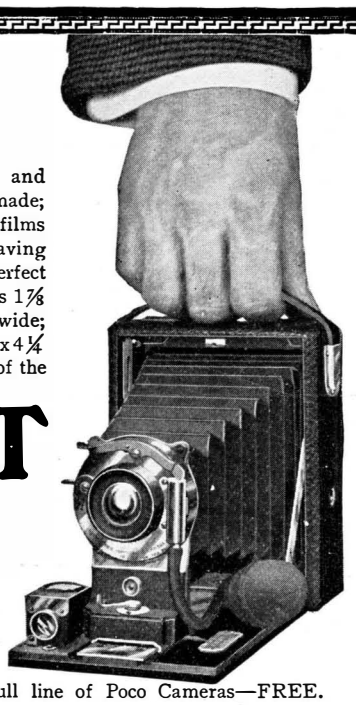

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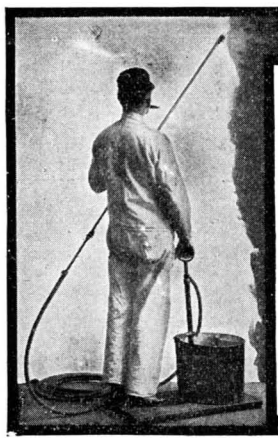

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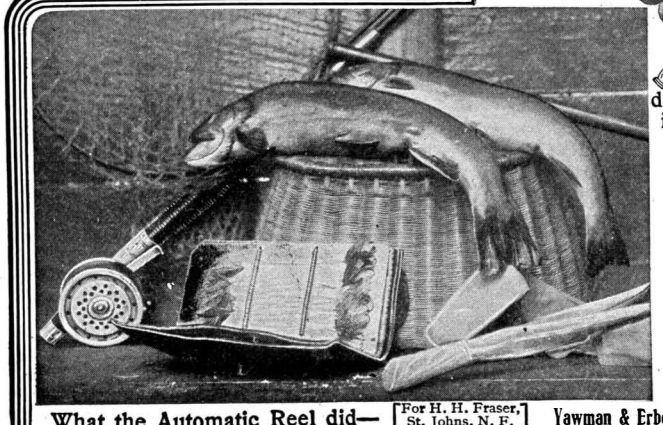

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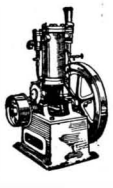

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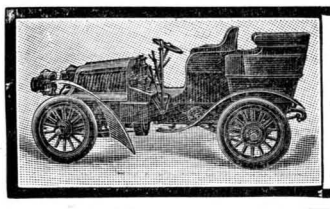

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